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Report

ON

MEDICAL AND SANITARY MATTERS

IN

MAURITIUS

BY

ANDREW BALFOUR,
C.B., C.M.G., M.D., B.Sc., F.R.C.P.E., D.P.H.,
Director-in-Chief, Wellcome Bureau of Scientific Research.

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Note.—The references to figures in the text refer to the photographs and plans accompanying the Report.

Report

ON

MEDICAL AND SANITARY MATTERS IN MAURITIUS, 1921.

To the Right Honourable the Secretary of State for the Colonies.

Sir,—

Prefatory note.

(1) I have the honour to submit a report on the mission entrusted to me by the Secretary of State for the Colonies in November, 1920.

At that time I received a communication from the Colonial Office asking if I was prepared to visit Mauritius with the view of investigating the sanitary condition of the Colony and the measures needed for the general improvement of the health of the population.

Unhealthiness of Mauritius.

It was explained to me that the Governor of Mauritius had represented that, despite the many natural advantages of the Colony, its general unhealthiness had reached a degree unparalleled in any similar tropical Dependency of the Empire.

Sanitary state of Port Louis.

The sanitary state of the capital, Port Louis, was stated to be particularly deplorable and the unfortunate conditions were ascribed to inadequate and inefficient administration. So far as Port Louis was concerned stress was laid on the division of control between the Medical and Health Department on the one hand and the municipal authorities on the other, and it was pointed out that, owing largely to difficulties arising from the war, the Medical and Sanitary Department had been unable to grapple with the situation.

Funds available. Terms of reference.

I was further informed that the Council of Government had voted a sum of at least Rupees 10,000,000 to be spent on sanitary improvement and that it would be my duty to advise in what way this sum could be expended to the best advantage and what reorganisation of the Medical and Health Department would be required for the efficient execution of such measures as might be found necessary.

Journey and route.

(2) Mr. Wellcome's consent having been obtained I accepted the invitation and, after some preliminary inquiries, sailed on February 11th, 1921, for Durban. There, owing to the difficulty of obtaining a passage to Mauritius, I was detained a fortnight and with the kind help of Dr. Park Ross took the opportunity of seeing something of what was being done in connection with the sanitation of sugar estates on the Natal Coast. I also paid a short visit to Zululand and inspected an interesting type of leper colony at Amatakulu, of which Dr. G. H. Wildish was in medical charge.

Obtaining a passage by a cargo boat, I left Durban on March 20th, and after calling at Delagoa Bay and witnessing the results of the remarkable recent development of Lourenço Marques, I reached Mauritius on March 31st.

Six months were spent on the Island according to arrangement and I sailed for England *via* Bombay on September 30th.

(3) It is unfortunate that my time was so limited, as my only experience of the hot weather in Mauritius was during the month of April, and it would certainly have been advantageous if I could have devoted another three months to the work.

Facilities afforded.

This, however, was impossible, and, thanks to the facilities afforded me by the Mauritian Government, I was able to visit every part of the Colony and to conduct an exhaustive inquiry into the various problems requiring solution. I received every possible assistance and encouragement and experienced during my stay on the Island much kindness and hospitality.

Consulting Sanitary Engineer.

Just before I left, there arrived Mr. E. L. Mansergh, the Consulting Sanitary Engineer, who had been appointed to advise on various questions connected with the sewerage and water supply both in Port Louis and in the Plaines Wilhems District.

We had several conferences, but in the brief time available it was not possible to enter as fully into matters with him as I would have liked.*

Acknowledgments.

(4) It is both a duty and a great pleasure to record my indebtedness to His Excellency, Sir Henry Hesketh Bell, K.C.M.G., the Governor, who recognised how important it was to remedy the deplorable medical and sanitary condition of the Island, and to whose initiative is due the action of the Council of Government in levying a tax on sugar in order to secure funds for carrying out the much-needed improvements.

I enjoyed for a month the kind hospitality of Government House and the assistance of the Governor's A.D.C., Captain G. Lightfoot. His Excellency took a warm interest in my mission and did all in his power to render it a success. He had already taken action in several directions, and I soon found myself in accord with his views as to the chief causes which had occasioned a state of matters that was as surprising as it was disheartening.

To the Honourable the Colonial Secretary, Mr. E. B. Denham, C.M.G., who had not been long in the Island, I owe a debt of gratitude for the manner in which he seconded my efforts and for the trouble he took to furnish me with advice and information. I feel that Mauritius is fortunate in possessing an official of so much ability and energy and one who is so keenly interested in education and in all questions having a bearing on the public health. I received also much kind assistance from his staff, to whom my thanks are due for the arrangements made as regards my office work and the secretarial and clerical help afforded me.

It is a pleasure also to record the valuable assistance rendered me by Mr. P. Le Juge de Segrais, the Director of Public Works and Surveys, his Assistant, Major L. F. Regnard, R.E., and others on his staff, notably Mr. Daruty, who is in charge of water supplies.

To Captain B. A. Francis, Acting Receiver General, Protector of Immigrants and Poor Law Commissioner, to Mr. H. W. Prichard, the Acting Procureur General, to Colonel A. C. Godfrey, the Inspector of Police, and also to the Deputy Inspector, Major F. T. G. Tremlett, O.B.E., my hearty thanks are due for valuable information supplied me and for their co-operation with me in various branches of the work. In this connection a very special meed of indebtedness was incurred to Mr. A. Walter, F.R.A.S., the Director of the Observatory, who at the time of my visit was acting as Food Controller and on whose capable shoulders there fell also the burden of the census enumeration. In the form of "The Mauritius Almanac," which is compiled under his direction, there is issued annually a veritable storehouse of accurate information relating to well-nigh everything connected with the Colony. I have found this publication of great value, but, in addition, Mr. Walter has been good enough to aid me most materially in several ways and his experience and knowledge were always placed unreservedly at my disposal.

---

* I have, however, had the privilege of meeting Mr. Mansergh on several occasions since his return to England and of discussing various points with him. He has also been good enough to send me an early copy of the comprehensive *Report on questions of Water Supply and Sewerage of Port Louis and the Plaines Wilhems Towns*, by his firm. It is too late to refer fully in this Report to the findings, but here and there I hope to make reference to some of them.

I had the privilege of discussing many subjects with Dr. H. A. Tempany, the Director of Agriculture, and in matters entomological had the good fortune to be in touch with that well-known Mauritian entomologist, Mr. D. D'Emmerez de Charmoy, the Assistant Director of the Department.

The Rector of the Royal College, Mr. T. W. Eyre, placed his long experience of the Island at my service and Mr. A. M. Souter, the Acting Superintendent of Schools, furnished me with useful statistics.

Last amongst Government departments but by no means least I would record my sincere thanks to the officials of the Medical and Health Department. My mission naturally interfered with their routine work and increased very considerably their burden of responsibility, but, though already overtaxed, they made no complaint about the extra labour they had to undertake and very cheerfully and willingly rendered me every possible assistance. This is especially true of the Acting Director, Dr. F. J. R. Momplé, D.P.H., who, though suffering from the effects of a very trying experience during the great influenza outbreak and from the worries and anxieties of a difficult position, showed me a degree of courtesy and displayed an anxiety to help me which I greatly appreciated.

Dr. A. L. Castel, the Acting Chief Sanitary Officer, accompanied me in nearly all my inspections and I found his intimate knowledge of the Island invaluable. He enlightened me on many points associated with the malaria problem and supplied me with data, the compilation of which must have cost him much time and trouble.

To Dr. L. G. Barbeau, D.P.H., the Director of the Bacteriological Laboratory, Réduit, and to his staff, I am also much indebted. Dr. Barbeau rendered me very notable assistance on many occasions and never more so than when the first case of plague occurred in Port Louis.

Dr. F. L. Keisler, D.P.H., aided me by his knowledge of conditions in the capital and in the Black River District, of which he is the Sanitary Warden, while to Dr. A. Rouget, Superintendent of the Civil Hospital, Port Louis, to Drs. Chauvin and Leclézio and to other medical officers I would express my grateful thanks.

Nor must I forget the good services rendered me by several of the Sanitary Inspectors and more especially by Mr. L. A. Bouquet in Port Louis, Mr. Salèce of Curepipe, Mr. J. D. Leonce of Moka, and Mr. W. L'Etang at Souillac, in the District of Savanne. I was favourably impressed by the interest these inspectors took in their work and by their efforts in the cause of sanitation.

Colonel D. McKechnie, R.E., the officer commanding the garrison, supplied me with information on several points and the Medical Officer in charge of British Troops, Major F. Casement, D.S.O., R.A.M.C., very kindly undertook to breed out mosquito larvæ for me and assisted me in some experimental work.

To certain of the unofficial members of the Council of Government, both in their public and private capacities, I would record my sincere obligations for help, advice, encouragement and that hearty hospitality for which Mauritius is famous. More especially would I mention the Honourables A. Duclos, C.M.G., M. L. A. Noël, C.B.E., M. d'Unienville, G. Antelme, P. Raffray and E. Nairac. The last named being the Mayor of Port Louis, I was brought intimately into association with him in connection with the remedial measures which had to be put in force during the time I was resident in the Colony. I found Mr. Nairac at all times sympathetic and anxious to aid me to the best of his ability. Our relations throughout were most cordial and pleasant and I feel this was largely due to the friendly attitude he adopted from the first and which greatly simplified my work.

To this already lengthy list it is essential that I should add the names of Dr. E. L. de Chazal, one of the leading private practitioners in Mauritius and one of the most public-spirited of her sons, Dr. W. T. Edwards, C.M.G., the Chairman of the Board of Commissioners of Curepipe, Mr. Marion de Procé, its architect, Mr. E. Leclézio, who holds a similar position to that of Dr. Edwards in respect of Quatre Bornes, Mr. Pitot, the Secretary of the Beau Bassin - Rose Hill Board, all of whom placed their knowledge freely at my disposal. So did an old and esteemed Mauritian resident in the person of Mr. Shand Harvey and so did one of the latest comers to the Island, Dr. T. B. Gilchrist, D.P.H., who, on my recommendation, was appointed Medical Officer of Health for the Port Louis District and who speedily made his presence felt.

My Secretary, Mr. Frederick Chastellier, was assiduous in his work and proved himself throughout courteous and obliging. His acquaintance with local conditions was often of considerable service and I am indebted to him for the manner in which at times he worked under high pressure.

The local Press took a lively—sometimes a very lively—interest in the inquiry and it was gratifying to find it so concerned about public health matters. There are many others to whom my acknowledgments are due, such as the managers of various sugar estates, but it is impossible to mention everyone by name. I would, however, make an exception in the case of Mr. P. G. Bumstead, the Acting Government Printer, for the great trouble he took to get all my interim reports issued before I left the Colony.

In concluding this section I can only say that I carried away very pleasant recollections of Mauritius and its people and remember with gratitude the assistance given me both by those to whom I have had an opportunity of alluding and to others who did much to further my inquiry, though, owing to lack of space, they are not specifically mentioned.

INTRODUCTORY REMARKS.

THE COLONY.

It would appear unnecessary to enter into a lengthy description of Mauritius.

Both Ross and Fowler, in their excellent reports on malaria in the Island, give an account of it, as does Anderson in his "Epidemics of Mauritius."

GENERAL FEATURES.

It seems, however, advisable to mention a few facts, sufficient to enable readers of this Report who are unfamiliar with the Colony to gain some general idea of its chief features without having recourse to other sources of information.

Brief description of Mauritius.

Mauritius is an island shaped rather like an oyster shell, with the narrower end pointing north. It is situated in the Indian Ocean between latitude 19° 50′ and 20° 31′ south and longitude 57° 18′ and 57° 48′ east of Greenwich, and is thus just within the tropic belt. Owing, however, to its southerly situation, its immediate surroundings and the influence of the Trade Winds, it by no means conforms to the customary idea of a tropical island. It is nearly 39 miles long and its greatest breadth is 29 miles. Its area closely corresponds to that of the county of Surrey, being 716 square miles, while that of the home county is 758. Situation. Size.

Scenery. Moreover, some parts of the Island, notably Curepipe and Vacoas towards the summit of the central plateau, recall in some measure certain features in the scenery of Surrey and make it hard for the visitor to realise that he is in the southern tropics many thousands of miles from the heights of Hindhead or the fir-bordered roads of the Farnham district. So varied is the scenery, so bold are the mountain ranges, so large some of the rivers, so extensive some of the inland vistas, that it is difficult to appreciate the fact that one is on a small island. It suggests a continent in miniature, yet it is impossible to go far in any direction without coming in sight of the sea and the line of snowy white where the breakers beat ceaselessly on the encircling coral reefs.

CLIMATE.

Climate. Mauritius is favoured in the way of climate. The latter is mild and equable. The maximum shade temperature recorded at the Observatory, which is 178 feet above sea level, has never exceeded 95° F., while in the highlands, as, for example, at the residential capital Curepipe, 1,800 feet above the sea, it rarely reaches 80·4° F.

Temperature conditions. The relative humidity is high and hence during the summer the heat is at times oppressive, especially in the lowlands and more particularly in the capital, Port Louis, which lies at the base of an amphitheatre of lofty hills.

The hot weather begins in October and continues till the end of April. but neither October nor April are really disagreeable months. The maximum temperature is usually registered in January and February and these months with December and March may be accounted unpleasant in the coastal zone. From May to September the climate is delightful, though a trifle cold and damp in the loftier parts of the highlands. Curepipe, indeed, is a very rainy place. Owing to the high relative humidity the climate is sometimes disagreeable during this season of the year, though the temperature never and nowhere falls below 44·6° F.

Rainfall. The rainfall varies a good deal in different parts of Mauritius, the mean annual fall ranging from below 29·9 inches on the North and West to 150·9 inches on the Central Plateau, where in years of maximum rainfall it exceeds 196·8 inches. Rain falls practically all the year round in the higher parts of the Island. A distinct wet and dry season can only be differentiated in the coastal regions, but, speaking generally, it may be said the rainy season begins in December, attains a maximum in March and gradually decreases till June. There is a second maximum in August. The dry season occurs in October and November, but an area like the Black River District suffers more or less from drought all the year round. The same is true to a lesser extent of Rivière du Rempart in the North. During cyclonic disturbances, which are not infrequent, torrential rain may fall, a point of importance in connection with anti-malarial works (1).

PHYSIOGRAPHICAL AND GEOLOGICAL CONSIDERATIONS.

Such physiographical features as require notice will receive mention in the body of the report in connection with matters on which they have a bearing. The map also furnishes information regarding them.

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(1) The Mansergh report gives important data regarding the rainfall in connection with the question of water-supply.

Volcanic nature of island.

Here it need merely be said that Mauritius is of volcanic origin and its rocks are thus basaltic, consisting largely of trap, trachyte and lavas.

Porosity of soil.

Some of the lavas are highly porous and two varieties can be distinguished, *i.e.*, those containing large cavities and those with small pores filled with calcareous infiltrations. This porosity has an important bearing on health conditions, for in many parts the ground dries after rain with remarkable rapidity.

Hence there are localities where surface water does not remain for any length of time, while out-door recreation can be taken soon after heavy showers, a matter of considerable hygienic importance.

As is sometimes forgotten it is essential to consider soil, sub-soil and deep-lying strata when discussing the effect of telluric conditions on the public health, at least in tropical countries where malaria is rife.

Presence of clay and clay beds.

It must be remembered that the above-mentioned soil porosity does not exist everywhere on the Island. There are many parts where beds of clay underlie a red soil consisting of a mixture of gravel and clay. Again there are areas of black clay, which is by no means porous, and in both situations water is apt to collect and stagnate, as Fowler pointed out. He speaks also of the conditions obtaining in certain parts of the littoral. Here the soil is sandy, but it is mixed with coral trash and there are places where swamps exist, possibly because there are underlying clay beds, possibly because a mixture of sand, coral and decaying vegetable organic matter forms a somewhat impermeable layer, the interstices between the sand grains and the coral being occupied by a jelly-like substance impervious to water.

Rock outcrops.

Here and there, also, are places where sheets of dense rock outcrop on the surface and where pools form after rain and remain long enough for mosquitoes to breed out in them.

POPULATION.

Population. Census of 1921.

The census was taken during the time I was in the Colony and it is estimated that the total population is 376,108.

At the date of the last census, March 31st, 1911, the total population amounted to 368,791.

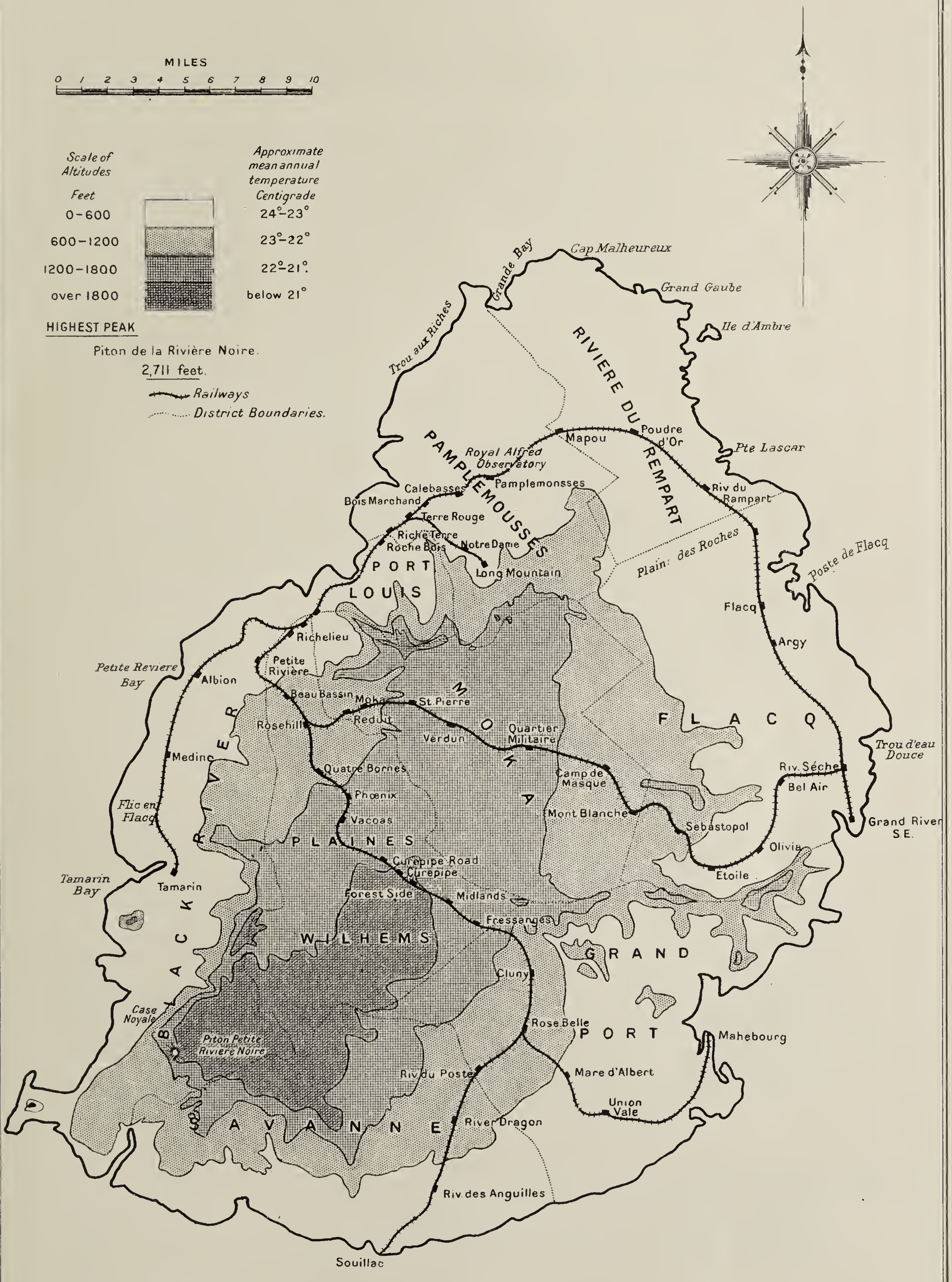
Thus during the last decennial period the increase has only been 7,317. This is explicable to a slight extent in terms of emigration, as the latter has exceeded immigration during the last ten years, but the chief explanation is, I think, undoubtedly to be found in the high rate of mortality, especially as regards the infantile death rate, and this again is due to insanitary conditions, using the word " insanitary " in its widest sense.

Mauritius compared with Trinidad.

Comparisons of increases in population in different countries are always apt to be unsatisfactory, because so many determining factors have to be taken into account. It does, however, appear to me suggestive and useful to institute such a comparison between Mauritius and an island with which I am familiar and which, in many respects, and more especially in the general constitution and number of its population closely resembles it, viz., Trinidad, B.W.I. What may be termed the " natural increase " of the population in the latter Colony for the last ten years, that is, the increase independent of immigration, amounts approximately to 22,000, a very different figure to the 7,317 for Mauritius.

As I say, I admit the fallacies inseparable from such a comparison, but the latter undoubtedly has a certain value and is significant when it is

MAP I



MAP OF MAURITIUS SHOWING ALTITUDES, DISTRICTS & RAILWAYS.

BY A. WALTER, F. R. A. S.

WATERLOW & SONS LIMITED, LONDON, DUNSTABLE & WATFORD

remembered that in Trinidad there has been, for well nigh a decade, great sanitary activity and that the health of the island has benefited markedly thereby.

Constitution of population

The inhabitants of Mauritius comprise Europeans, whites born in the Island of European descent and mostly of French origin; Indians, who form by far the largest section of the population, and have either been born in the Colony or are immigrants from India; Africans and Chinese.

There is a large mixed population of all the various races.

Perhaps the best classification is that given by Sir Henri Leclézio in MacMillan's "Mauritius Illustrated."

Classification of population.

Writing a short time before the war he groups the sections into:—

(*a*) The white population of some 10,000 people, chiefly French, with a few English or Anglo-Mauritian families.

(*b*) Gentry of colour, well educated persons often holding high positions, somewhat exclusive and numbering about 5,000.

(*c*) A coloured middle class, numbering perhaps 15,000, fairly well educated and often filling responsible posts. It comprises clerks, school-teachers, skilled artisans, shopkeepers, railway employees and others.

(*d*) The working classes, which he with truth describes as intellectual to a certain degree, and which are certainly highly intelligent. In these the Malagasy-African blood predominates, and they are the descendants of liberated slaves. There are approximately 55,000 of them, and I may say they are a difficult class from the hygienic point of view.

(*e*) Indians who are divided into Christians, Hindoos, Mohammedans and others. There are now about 260,000 of them, and they are slowly but surely taking possession of the land.

(*f*) Chinese, who are mostly shopkeepers and who have the drink trade in their hands, a very important matter as will be seen. Their numbers keep fairly steady and may be placed at 3,200.

Density of population.

I have entered somewhat into detail as regards the population, for it is important to understand how heterogeneous it is. Sanitary progress is always difficult among such a community, and there are special features in the Mauritian population which enhance the difficulties. The very smallness of the Island, which in some respects might be thought an advantage, militates against sanitary endeavour. For one thing there is a great density of population, which exceeds 500 persons to the square mile, for another a great number of people are related to one another, and naturally this does not favour the stringent action which is often necessary if sanitary regulations are to be enforced.

Isolated position of Colony.

The isolated position of the Colony, an isolation which has of recent years become intensified, is another factor which must be taken into account. Many of its inhabitants, including men of good education occupying important situations, have never been out of the Island, and there are many instances in which men who visited Europe in their youth returned to Mauritius and never quitted it thereafter.

Such a state of matters is naturally not conducive to a wide view being taken of local conditions, and, as will be seen, it has played its part in bringing about the decadence in medical administration on which it was my duty to report and advise.

ARRANGEMENTS FOR INVESTIGATION.

Investigation.

As stated, I reached the Island at the end of March, 1921. Arrangements had already been made for my enquiry, so that I found a commodious office and a well-trained Secretary awaiting me, and later was supplied with a typist. My headquarters had been fixed in Government Buildings, Port Louis, and this proved most convenient, as I could easily get into touch with the different Government Departments. His Excellency the Governor was at that time returning from a visit to Ceylon, but his Deputy, the Colonial Secretary, did everything he could to smooth my path, and later when Sir Hesketh Bell arrived I stayed for a month with him at Government House, Réduit, and so had many opportunities of discussing the situation in all its complexities and of profiting by his ripe experience.

Changes due to introduction of motor traffic.

A motor car was placed at my disposal. Without it I could never have carried out my duties properly. The advent of the autombile has made an immense difference to Mauritius. It is now possible, within the period of a working day, to visit the most outlying parts of the Island and return to the base of operations. Ross was hampered in his inspection owing to difficulties of transport, even though the Island was, at the time of his visit, nearly as well supplied with railways as it is at present. The motor car and the motor bicycle will also render it much easier to carry out preventive work. During the six months I was in Mauritius I motored over 10,000 miles, and yet had ample time for the necessary office work and even for occasional recreation.

OUTLINES OF ENQUIRY.

Scheme of work.

My first duty was to go through the pile of files which had been awaiting me, and the perusal of which served a useful purpose in making me to some extent familiar with local conditions and problems.

Preliminary enquiries.

Papers on all kinds of questions had accumulated. Many matters had been shelved pending my arrival, and it took some time to wade through the mass of detail. Fortunately, as the result of study before leaving England and during the voyage, I had obtained some knowledge of Mauritius and its medical and sanitary conditions, and was thus able to read the various minutes and documents with a certain degree of understanding.

Inspections.

Thereafter I commenced my inspection work by a survey of the town of Port Louis and the adjoining district. This was followed by a systematic examination into the conditions obtaining in the chain of townships forming the urban area of Plaines Wilhems District and extending from Beau Bassin to Curepipe. On the completion of this inspection I visited in turn the different districts of the Island, enquiring fully into both medical and sanitary matters and occasionally re-visiting places of special importance.

Interim reports.

It was considered advisable that I should record my impressions and recommendations before leaving the Colony, so that, whenever possible, speedy action could be taken. Accordingly in the intervals between inspections the following eight interim reports were written :—

(1) Report on the Sanitation of Port Louis.

(2) Report on Communicable Diseases in Port Louis.

(3) Report on the Sanitation of Beau Bassin, Rose Hill, Quatre Bornes, Vacoas and Curepipe.

(4) Report on Sanitary Matters in the Districts of Grand Port and Savanne.

(5) Report on Sanitary Matters in the Districts of Rivière du Rempart and Flacq.

(6) Report on Sanitary Matters in Black River District and the Extra Urban Area of Plaines Wilhems.

(7) Report on Sanitary Matters in the Districts of Moka and Pamplemousses.

(8) Report on Medical Matters in Mauritius.

These reports deal largely with details and are intended to serve as guides to those who have to carry out such recommendations as are adopted.

Memoranda.

As a result the present report will be found of a more general nature, but it will consider some important matters not mentioned in the interim reports and in certain directions will amplify and confirm what has already been discussed. A list of memoranda submitted will be found in Appendix I.

THE MEDICAL AND HEALTH DEPARTMENT.

Constitution of Medical and Health Department.

Professional staff.

At the time of my visit this was constituted as follows, so far as its higher ranks were concerned :—There was an Acting Director, who had no one to act as his whole-time deputy or assistant, though he could call upon the services of one or other of the medical officers working from the head office in Port Louis. These were the Chief Sanitary Officer and Malaria Authority, who was also Sanitary Warden (a term corresponding to that of Medical Officer of Health) for the districts of Port Louis, excluding the town itself, Pamplemousses, Rivière du Rempart, Flacq and Moka, a large area containing a population of 160,137 and the Sanitary Warden of Port Louis, who combined also the duties of Port Health Officer and Sanitary Warden of the Black River District.

It is clear that neither of these officers had much time to spare in the way of assisting the over-burdened Acting Director.

An Acting Sanitary Warden without a public health qualification was, in the intervals of private practice, looking after the sanitary needs of the 61,025 persons inhabiting the urban area of Plaines Wilhems. He had also under his charge the extra urban area of that district and the large districts of Grant Port and Savanne, so that the total population for which he was responsible amounted to 152,208.

The medical staff of the large Civil Hospital, Port Louis, consisted only of a Medical Superintendent and one Resident Medical Officer. The large hospital at Beau Bassin, known as the Barkly Asylum and the neighbouring Lunatic Asylum shared the services of two medical officers, one of whom acted as Medical Superintendent of both institutions, the post of Superintendent of the Barkly Asylum being vacant. The other was a part-time officer permitted to engage in private practice.

There were eight Government Medical Officers whose duties varied somewhat according to the districts under their charge. Where the districts contained Government Hospitals, as was the case, with one exception (Black River), they acted as Medical Officers of those hospitals and in addition carried out as a rule dispensary work both at the hospitals and elsewhere, vaccination, medical examination of Government employees, medico-legal examinations, examination of alleged lunatics and very often in addition certification of deaths.

Some of the Government Medical Officers were permitted private practice.

The case of the Government Medical Officer of the Plaines Wilhems District was somewhat peculiar, inasmuch as the Government Hospital under his charge was that in the Civil Prison and instead of dispensary work he looked after the Reformatory, Rose Hill, and attended the European police at Curepipe.

The holder of the post was absent on leave and his duties were being performed by the Director of the Bacteriological Laboratory at Réduit.

Another of the Government Medical Officers was on leave and his place was taken by one of the Dispensary Medical Officers, whose ordinary duties were being performed by a temporary officer engaged in private practice. There were in all three Dispensary Medical Officers, who, in addition to their dispensary work, performed vaccination and examined alleged lunatics and in two instances were Commissioners in Lunacy.

The duties of the Dispensary Medical Officer, Port Louis, were more extensive, comprising domiciliary visits to the sick poor, the medical charge of police and prisons, medico-legal examinations, the certification of deaths and work in connection with the Medical Board for the examination of Government servants applying for permission to retire from Government service. In addition to the above there were three part-time Assistant Government Medical Officers engaged in dispensary work and vaccination. Two of these were also responsible for the examination of alleged lunatics, the third for certification of deaths.

There was thus a total acting staff of 22, but of these five were part-time officers and even of the remainder six were permitted private practice.

It seems advisable to give these details if only that a comparison may be instituted between the conditions obtaining at the time of my visit and the recommendations put forward for the reorganisation of the department. (See p. 117 *et seq.*)

Moreover, they help to explain the admittedly unsatisfactory state of medical matters in the Colony, as do the following considerations, which it is necessary to bear in mind.

(1) The late Director of the Department quitted Mauritius for military service in the summer of 1914 and died during the course of the war. As a result the administration of the Department has been in the hands of an Acting Director, who has been placed in a difficult and unsatisfactory position as is usually the case under such circumstances.

Conditions militating against efficiency.

(2) The difficulties of the position were accentuated by the war which made it impossible to secure new recruits for the service, led to a shortage of medical supplies and stores, prevented the execution of many works of pressing importance and in other ways militated severely against efficiency.

(3) The unprecedented epidemic of influenza which scourged the Island in 1919 threw a very heavy strain on the Department, depleted it, either temporarily or permanently, of many of its staff and taxed its resources to the uttermost.

(4) There has not been sufficient recognition of the fact that everywhere the salaries of medical men in Government employ have had to be greatly increased and that even the newly-fledged medico can now command a rate of pay which, prior to the war, would have been considered excessive. As a result, Government medical service in Mauritius has lost whatever attraction it once possessed for young and enterprising practitioners or hygienists and, owing to this and other causes, such as a failure to appreciate the acquirement of special qualifications and lack of security of tenure, the Department has become sadly depleted and quite unable to cope with the situation.

The term "lack of security of tenure" is here used in two senses. Of recent years there have on the one hand been many temporary appointments which have not proved satisfactory and, on the other, circumstances have rendered it necessary to shift men from one post to another so that a medical officer could never be sure how long he would remain in any one place. This has been a fruitful source of dissatisfaction and has deterred possible applicants from taking service under the Department.

(5) The isolated position of Mauritius, especially during the war period, and the fact that there have been, in the past, practically no opportunities for study leave, have rendered it well-nigh impossible for Medical Officers to keep up-to-date. It is within the last ten years or so that the most remarkable progress in tropical medicine and hygiene has been recorded, but this progress has left Mauritius very largely in a backwater, in great measure owing to the reasons above stated.

(6) The supply of medical literature has, in the past, been quite inadequate. Its paucity was the outcome of that economy which had to be practised before the famous sugar coup revolutionised, at least temporarily, the financial status and outlook of the Colony. Its effects were serious, for nowadays, if a Medical Department is to be efficient, it must keep itself abreast of the times and avail itself of all useful sources of information.

(7) A pernicious system of centralisation and a multiplicity of quite unnecessary routine and paper work has served to damp enthusiasm, smother activity, favour delay in action and prevent inspection duties being properly carried out.

(8) The shortage of staff has prevented leave being taken and has led to bodily and mental fatigue in the case of those on whom the burden of responsibility has rested.

(9) There has been a policy of drift, imposed in part by the above-mentioned factors, as well as by the delay occasioned owing to the necessity of waiting for a full enquiry into the situation.

(10) Criticism, at times, no doubt, justified, at times unreasonable, has largely taken the place of assistance and recognition of such efforts as have been made to grapple with a difficult situation.

Doubtless, other causes have also been operative in promoting inefficiency such as the resistance, active or passive, offered to sanitary progress; but, after six months' close study of the situation, I believe that those just cited are the main factors, and it will be seen that some of them could not well have been avoided.

HEALTH CONDITIONS.

Past medical history of Mauritius

Although it is true that, prior to the great outbreak of malaria in the late sixties of last century, Mauritius, owing to its remarkable climate, enjoyed the reputation of being in some measure a sanatorium, there is evidence that the Island was not in the strict sense of the word healthy, at least for many years prior to the malaria epidemic.

Account by Flemyng.

The remarks of the Rev. Francis P. Flemyng, an Army Chaplain, in a little book which he published in 1862, entitled "Mauritius or The Isle of France," are of special interest in this connection. He was in the Colony in 1854, at a time when it was scourged by cholera, and he records his impressions as follows:—

Cholera outbreak.

> "The overstocked state of the population, and the want of proper precaution respecting the vital sanitary points of *ventilation* and *cleanliness* amongst the inhabitants, having unfortunately tended to foster this virulent disease [cholera] in the Colony; and the recent and more frequent recurrences of its fatal effects lead one to fear that unless very energetic rules be enacted and *enforced*, and that speedily, it will become endemic in the Island and Mauritius will

> soon be as noted as India for the prevalence and destructive visitations of the dreaded cholera.
>
> "During its visit in 1854, one of the first orders issued by the prefects of police was 'that all pigs found on the Island should be destroyed' it being deemed desirable that they should be prevented from rooting and overturning the *débris* in the streets and yards of the towns and villages, and also that the use of their flesh as food might be the more effectually prevented. On the promulgation of this order, the police commenced patrolling their districts, and all luckless swine that were discovered by them were immediately seized thrust into sacks and conveyed to the coast; there they were placed on board a number of pirogues, or long canoes; by these they were taken out to sea and mercilessly drowned; the whole operation being continuously and loudly protested against by the victims amidst cries, grunting and squealing, that was anything but agreeable to those whose dwellings (like the author's at Mahebourg) happened to be in the immediate vicinity of the places of execution.
>
> "Important as this measure was, a still better sanitary arrangement surely would be *permanently to prevent* the Creoles' swine from ranging about at large, feeding on offal, dead fish and such unwholesome food, and when in search of it, turning up the dirt and filth around the dwellings and on the coast. Doubtless, the want of proper attention to sanitary regulations throughout the Colony greatly tends to engender and spread these epidemic disorders, and we believe that, were it not for the merciful and providential hurricanes which visit this Island and thoroughly sweep and cleanse its surface and dwellings the place would never be without disease; for a worse-drained and dirtier-conditioned place it has certainly never been in our experience to visit amongst the colonial dependencies of Great Britain. The Creole 'boutiques,' or shops, in the rural districts, together with the dwellings, outbuildings, yards and stables of the lower classes are lined with dirt, whilst the carriages, cattle-yards and premises of the better class of Creole proprietors display the same inattention to habits of cleanliness, neatness or order. As a rule, applicable to the whole population of the Colony, we would say that 'want of cleanliness' was the great social evil that was most apparent everywhere on this Island. Such a want, where there is abundance of water, is most culpable and lamentable; and assuredly until it be energetically rectified, cholera, typhus, small-pox and such-like deadly and epidemic pestilences may not only be looked for, but will be found *permanently* existing."

Insanitary conditions.

Elsewhere he speaks of the coolies in Port Louis being packed together in their "black towns" amidst surroundings of filth and squalor, while in another place he says, speaking of the Island :—

> "Everything is imported and nothing seems indigenous, if indeed we except the mosquitoes and the rats which seem to grow out of the soil everywhere."

Even if the reverend gentleman's views on epidemiology are, in the light of present knowledge, none too sound and even if his prophecy has not been fulfilled to the letter, although cholera did revisit the Island on two occasions, there is no reason to doubt the accuracy of his observations as regards the sanitary state of Mauritius in those days.

The pity is that a good deal of what he wrote is still applicable.

Dr. Andrew Davidson's account.

So much for a layman's opinion. That of a distinguished medical officer, Dr. Andrew Davidson, may with advantage be quoted.

In his "Inquiry into the Causes of Malarial Fever in Mauritius," published in 1880, he gives a table by Dr. Mann comparing the death rates of troops in various British Colonies and adds to it that of troops in the United Kingdom for the years 1860-1864.

Commenting on the figures he says :—

> " There is only one conclusion to be derived from this table, viz., that Mauritius was never a healthy place. The mortality though much less than that of various tropical countries was nearly *three times* that of Great Britain."

Views of Meldrum.

It is true that later Davidson qualified the word " never " to some extent, and that Charles Meldrum, a well-known meteorologist and statistician took exception to his figures, and conclusions, but he was not a physician and Davidson's observations, despite some faulty comparisons and reasonings, cannot fail to carry conviction. He amplifies them in an interesting, if somewhat polemical report dated 1882 on " The Sanitary State of Mauritius, past and present, and the Causation of Malarial Fever," in a synopsis of which occurs the statement :—

Freedom from malaria.

> " While Mauritius was free from malaria, dysentery was nevertheless a common and fatal disease both among the civil population and the military.

Prevalence of dysentery, simple continued fever and typhoid fever.

> " Simple continued fever, following the usual mild course of an ephemera, was observed every year during the fever-free period. It was rarely fatal and never recurrent or periodic.
>
> " Typhoid fever seems to have been by no means rare. From the year 1838 local outbreaks of a dangerous continued fever, known in Mauritius as Bombay fever, were from time to time observed in the Indian camps on sugar estates. There is good reason for believing that the so-called Bombay fever was really nothing else but typhoid fever.
>
> " Since the Colony has become malarious typhoid fever has become much less common."

Bombay fever.

The last statement is significant and suggests that errors in diagnosis were not infrequent, cases of " enterica " being frequently classed as malaria, a state of matters which I believe exists to-day. As regards Bombay fever it is now considered to have been a form of relapsing fever though doubtless many of the cases were due to typhoid fever, a view Ross supports.

Report of Sanitary Commission, 1882.

A Sanitary Commission which was appointed in Davidson's time, and of which he was a member, reported that it " is compelled with regret to own that the mortality in the Colony is high; the health of the community in certain districts very much impaired by fever; the sanitary state of the Colony defective; and the results of past efforts at sanitation disappointing."

Chadwick's reports.

A decade later, an able and far-seeing sanitary engineer, Osbert Chadwick, in a series of remarkable reports pointed out many deficiencies, issued many warnings, and made many valuable suggestions, while Dr. J. Bolton, a local hygienist, wrote vigorously on the subject of sanitation in Mauritius. He is quoted by Anderson, and I had an opportunity of studying his writings in the Colony.

Dr. Edwards.

Dr. Edwards of Curepipe also from time to time through a long period of years drew attention to defects in sanitation, while Committees appointed to enquire into the prevalence of various diseases and insanitary conditions have not been lacking.

Kendrick's report.

Shortly before my visit Dr. J. F. Kendrick of the Rockefeller Foundation had made a survey of the Island in connection with a proposed campaign against ankylostomiasis. He furnished two reports. The first, unpublished, dealt shortly with the unhygienic state of the Colony, which, in view of the progress he must have witnessed elsewhere in the tropics, must, it is to be feared, have occasioned him considerable surprise.

STATISTICAL CONSIDERATIONS.

Medical statistics.

The health of a community can usually be gauged from a consideration of its vital statistics, and its sanitary state from a study of the returns relating to its communicable diseases. While, speaking generally, this is true of Mauritius it is to be feared that very little reliance can be placed on many of the figures furnished yearly by the Registrar General. This is especially true of those returns which depend upon accuracy in diagnosis, for, as will be seen, the microscope is not used as it should be in Mauritius, and without its aid the diagnosis of certain febrile conditions is to a large extent guess work.

Birth-rates and death-rates.

Even, however, in the case of birth-rates or death-rates grave misgivings have been expressed. There can be little doubt that a considerable number of births are not registered, while a few fallacies have been discovered in the death returns. Mr. Walter refers to these in his Parliamentary Report on the Census made on May 20th, 1921. He thinks the comparatively large difference, i.e., 11,001, between the estimated and censused population for the whole Island suggests the possibility of errors in registration.

By these he means errors of omission or commission inadvertently made by the public over which the registration department has no control.

I do not mean to say that these are serious but they engender a feeling of uncertainty about the accuracy and value of the vital statistics of the Island, and there is certainly an impression abroad that an enquiry should be instituted and steps taken to improve matters. Under the circumstances I feel that no very useful purpose can be served by quoting largely from the statistics available.

Census of 1921.

In any case there is likely to be more accuracy in the returns for 1921, as during this year the census was taken and it will be possible to make calculations on an actual and not on an estimated population. As an example of an error due to faulty estimate of a population, one may take the case of Port Louis.

Errors in death-rate of Port Louis.

The Registrar General reported the death-rate for the Port Louis District for 1920 as 47·3 per 1,000 and I quoted this figure in my report on the sanitary condition of the capital. Before I left Mauritius, however, the new census figures were available and it was shown that, contrary to expectation, there had been a considerable increase of the population of the district. Hence the death-rate was really 37 per 1,000, a high figure certainly, but very much less than that given by the Registrar General.

Yearly deaths and death-rates.

Doubtless such a state of affairs is exceptional, and, for comparative purposes, the following table referring to the total population may be considered as having a definite value :—

Years.		No. of Deaths.		Rate per 1,000.	
1915	... ...	13,101		34·8	
1916	... ...	11,432		30·4	
1917	... ...	12,234		32·5	
1918	... ...	12,794		33·9	
1919	from usual causes ...	13,392	24,455	35·5	64·9
	from epidemic influenza	11,063		29·4	
1920	... ...	11,773		32·3	

A table giving the death-rate *from usual causes* in the different districts for 1919 and 1920 (omitting the influence of epidemic influenza on the death-rates of 1919) may also with advantage be inserted, though the figures for Port Louis are incorrect :—

District death-rates.

Districts.	1919.	1920.
Port Louis	56·4	47·3
Pamplemousses	38·4	32·5
Rivière du Rempart	30·1	23·1
Flacq	37·3	29·9
Grand Port	33·5	39·0
Savanne	31·4	34·7
Plaines Wilhems	28·9	25·2
Moka	29·7	27·0
Black River	34·1	40·9

The comparatively low rate in Rivière du Rempart is probably to be explained by the fact that it is a dry part of the Island, while that in Plaines Wilhems is almost certainly due to the fact that in this district most of the white population and the better classes are congregated and that many of them live at a considerable altitude where there is little or no malaria.

Deaths due to communicable diseases.

I have extracted from the Registrar General's report for 1920 the return of deaths due to some of the more important communicable diseases and have arranged them alphabetically :—

Diseases.	No. of Deaths.
Ankylostomiasis	16
Diarrhœa (all cases not communicable)	308
Dysentery (type not specified)	499
Enteric fever	43
Influenza	334
Malaria	3,537
Tuberculosis (pulmonary)	974

I confess I cannot regard these figures as furnishing useful information. Indeed, they are only recorded here for purposes of comment.

Prevalence of ankylostomiasis.

Sixteen deaths are attributed to ankylostomiasis, but before Kendrick's survey there was no idea that ankylostomiasis was so widely prevalent. Its presence had been determined, but, generally speaking, it was ignored because the microscopic examination of stools was to a very large extent neglected.

The community was startled when Kendrick announced his estimate of 226,000 persons infected with the disease, or rather with the parasite, for the presence of ankylostomes does not necessarily mean ill-health.

Deaths due to ankylostomiasis.

Diarrhœa and dysentery as causes of death.

Still, the severer forms of ankylostomiasis are in evidence and it may well be doubted if 16 deaths represents the annual mortality from so prevalent a condition. It is at least certain that ankylostomiasis, by weakening resistance to disease, plays a great part in raising the general death rate of the Island. Diarrhœa and dysentery are really symptoms, not diseases, though it is true that the term dysentery, as commonly used, indicates one or other type of a malady recognised as a specific entity. When, however, it is remembered that many persons amongst the poorer classes in Mauritius die without having received medical attention and that diarrhœa and the symptom complex known as dysentery are not infrequently terminal complications, it is not surprising that they are recorded as actual causes of death. On the other hand in all probability some of the fatal cases of amœbic and bacillary dysentery are not notified as dysentery.

"Fever" deaths.

On enquiry I found that a great many deaths were returned as due to "fever," and it is the custom to class all these cases as "malaria." Hence the malaria returns are hopelessly inaccurate and personally I do not believe that over 3,000 people die yearly from malaria in Mauritius at the present time. I have seen what has been done in the way of combating the disease and though it falls far short of what is required, it must have had a considerable influence in reducing malarial morbidity and mortality. Indeed, there is definite evidence (non-statistical) that this is the case.

Malaria as a cause of death.

It can never be repeated too often that malaria is one of the most protean of diseases and can only be accurately diagnosed, at least for statistical purposes, by the use of the microscope. It simulates many diseases and many diseases closely resemble it. It has again and again been confounded with typhoid fever, with paratyphoid, with influenza, with chronic amœbic hepatitis and with tuberculosis, to mention only a few maladies, all of which are represented in Mauritius. Again, in view of what has been stated as to the return of deaths from "la fièvre," it must be remembered that there is an ankylostome fever, a fever associated with filariasis and that, in all probability, there are febrile conditions in the Colony which have not yet been properly differentiated.

Ross, in his report, devoted much time and thought to statistical matters. The Governor, in an interesting despatch dated August 28th, 1920, enters into the subject and comments upon the unsatisfactory nature of the returns and the apparent contradictions, and states that "the whole situation bristles with doubts and difficulties and it is hard to state, with any degree of accuracy, which are the diseases that are chiefly responsible for the increasing death-rate of the Island."

In speaking of malaria mortality and spleen-rate, he says "all these questions and many other points which relate to them can only be satisfactorily answered and explained by an expert on the subject."

Necessity for improved statistics.

I can only say that after six months' study of the situation I am quite certain that no expert can furnish the required explanation until a radical change is made (*a*) in the methods generally in vogue for the diagnosis of febrile complaints in Mauritius, (*b*) in the collection and recording of data.

One might argue, one might institute comparisons, one might draw deductions, but, in my opinion, it would be a mere waste of time. There is no bed-rock of fact. It would be only a groping in the dark. Hence it is better not to attempt an unprofitable task.

On the other hand it is necessary to discuss some of the diseases to which Mauritius owes its present unfortunate reputation and others which have a bearing on the situation.

In the case of some of these diseases, as, for example, typhoid fever and dysentery, preventive measures are so intimately bound up with questions of general sanitation that it is not advisable to consider their prophylaxis in this section of the Report. In the case of others, however, such as malaria and plague, the preventive measures are specialised and may with advantage be discussed along with the general account of the diseases.

COMMUNICABLE DISEASES.

Communicable diseases.

Some of these are discussed at considerable length in Anderson's "Epidemics of Mauritius," a work which contains useful historical references culled from various sources, while, so far as Port Louis is concerned, they were dealt with in my second interim report.

Malaria has within recent years formed the subject of two important monographs by Ross and Fowler respectively, while just prior to my visit Kendrick issued his report on ankylostomiasis.

There is no need in this report to traverse ground already covered, and, save for occasional necessary references to the past, it is intended, as far as possible, to deal solely with the present and the immediate future, and only with certain aspects of the diseases under discussion.

NOTIFIABLE DISEASES.

Notifiable diseases.

By the terms of Ordinance 47 of 1898, which was still in force at the time of my arrival in the Island, the following diseases were notifiable :—

> Plague, cholera and choleraic diarrhœa, small-pox, yellow fever, diphtheria and membranous croup, measles, scarlatina or scarlet fever and the fevers known by any of the following names, namely : typhus, typhoid or enteric fever even in its mildest forms, relapsing or continued, puerperal and traumatic erysipelas.

In correspondence with the Colonial Secretary I pointed out that this list was nowadays not very satisfactory. For example, the term " continued fever " does not connote a specific entity. As a matter of fact I found on enquiry that, for purposes of notification, it usually means enteric fever, which is itself notifiable.

Accordingly the recommendation was made that it be struck out of the list.

Changes required.

As the object of notification is not only to furnish statistical information but to enable preventive means to be put in force and as, in a place like Mauritius, it is practically impossible to do so in the case of measles, and as, in any case, our knowledge as regards the causation of measles is still defective and the methods of prevention incomplete, it seemed advisable to delete it also from the list, especially as it was desired to add dysentery. (See page 24.)

Dysentery and leprosy should be notifiable.

It was also considered highly desirable to make leprosy a notifiable disease and to specify paratyphoid fever, which no doubt had been classed as one of the above-mentioned mild forms of enteric fever.

The question of making filariasis and tuberculosis, at least in its pulmonary form, notifiable, was discussed, but it was decided for the present not to place them on the list. The facilities for microscopical examination are so scanty that notification of filariasis would undoubtedly be unsatisfactory while the cost of notifying phthisis would be very heavy and there is no proper organisation for coping with the disease from the prophylactic point of view.

Unsatisfactory state as regards notification.

The recommendations made led the Colonial Secretary to inquire into the whole question of notification and a very unsatisfactory state of things was disclosed. It was evident that many cases of communicable diseases seen by medical men were never notified. This is perhaps somewhat surprising as a fee of Rs. 2 is paid for each notification, but the fact remains that the fees paid yearly amounted to a trifling sum. As at present practised in Mauritius, notification is very largely a farce and this again proves how faulty are the statistics upon which the health returns are based.

ANKYLOSTOMIASIS.

Ankylostomiasis.

Incidence.

Of this important condition Kendrick of the Rockefeller Foundation, wrote that it " has been known to be prevalent in certain parts of Mauritius for many years, but no efforts had been made to determine the incidence of the disease. The general opinion of the medical men was that a considerable number of cases existed in some districts but no one thought that the degree of infection was what the present survey indicates it to be."

As already stated, Kendrick's estimate was that about 226,000 persons in the Colony were infected. He showed that the prevalence was greatest in the districts with the heaviest rainfall and that the labourers on the sugar estates were the class specially affected. He commented on the extremely faulty general sanitary condition of Mauritius and pointed out how it conduces to the dissemination of almost all forms of intestinal diseases. He noted how ankylostomiasis militates against the health, happiness and prosperity of the population and foreshadows the institution of an intensive campaign against the hookworm.

Proposals by Kendrick.

At a later date Dr. Kendrick formulated his proposals for such a campaign. Sir Hesketh Bell submitted a résumé of these proposals to me for my opinion and in view of their interest and importance I here transcribe them.

MINUTE.

CAMPAIGN AGAINST ANKYLOSTOMIASIS IN MAURITIUS TO BE CONDUCTED UNDER THE AUSPICES OF THE INTERNATIONAL HEALTH BOARD (ROCKEFELLER FOUNDATION).

RÉSUMÉ OF DR. KENDRICK'S PROPOSALS.

Co-operation with International Health Board.

1. The period of co-operation will extend over three years.

2. The International Health Board will supply funds for examining and treating the people and the Government will undertake to prevent infection and re-infection as far as possible.

3. Dr. Kendrick's report shows that soil pollution is general and that about 226,000 persons in the Colony are infected with ankylostomes. As all permanent results depend upon the proper disposal of night soil the work of latrine construction should precede the curative work.

I.—EXPENSES TO BE BORNE BY THE GOVERNMENT.

Conditions of work.

(*a*) The work of sanitation of the soil: Organisation of a division of soil sanitation to supervise the construction of sanitary privies. This will imply taking general steps to improve the sanitation and hygiene and the employment by Government of inspectors to carry out the sanitary measures required to prevent contamination of the soil.

(*b*) Organisation of a Department of Ankylostomiasis for the treatment and prevention of the disease (of which the division of soil sanitation shall form a part) of which the Board's representative shall act as Director during the period of co-operation.

(*c*) Free customs entry, transportation of all supplies used in the campaign, transportation of all employees (except the Director) when on official business, telegraph and postal frank on official business, printing and printing supplies.

(*d*) A Central Office in Port Louis and Offices in the districts where the work is in progress.

II.—EXPENSES TO BE SUPPORTED JOINTLY BY THE GOVERNMENT AND THE INTERNATIONAL HEALTH BOARD.

Staff required.

Staff required to operate the Scheme :—

1 Representative of the International Health Board Field Staff to direct the activities of the campaign during the period of co-operation.

1 Medical Assistant Director }
1 Secretary to the Director } to be employed locally.
3 Field Directors. }

9 Microscopists for the field.
1 Microscopist for the Central Office.

Scientific Equipment and Supplies. Drugs to treat 50,000 patients per year.

All appointments, also the removal of inefficient employees, shall rest with the Director.

Apportionment of the Expenditure.

It is suggested that the International Health Board shall pay :—

Sharing of expenditure.

During the first, second and third years 100%, 50% and 25% respectively.

The Government to assume the whole cost of operations after three years.

Fellowships offered by International Health Board.

III.—The International Health Board offers two fellowships to qualified medical men for instruction in public health matters in the United States. These fellowships provide $2,000 for a married man and $1,200 for an unmarried man, and free tuition. It also provides passages to and from the United States. The length of time required for this course is two years. Persons accepting the fellowships must undertake to accept Government employment in Mauritius upon completion of the course.

(Signed) H. HESKETH BELL,
Governor.

Government House,
Port Louis,
12th August, 1921.

A reply was sent to His Excellency's query as follows :—

ANNEXURE TO H.E. THE GOVERNOR'S MINUTE No. 21 OF 1921.

Government House,
Port Louis,
13th June, 1921.

Memorandum on proposals.

" Sir,—I have read Dr. Kendrick's interesting and valuable report and the correspondence which has arisen in connection with it. Being familiar with the Ankylostomiasis work carried out under the auspices of the Rockefeller Foundation, I have no hesitation in recommending that the offer contained in Dr. Kendrick's letter of December 13th, 1920, be accepted and that the Mauritian Government co-operate whole-heartedly in the effort to stamp out ankylostomiasis in this Colony. Formerly the Rockefeller campaigns were devoted chiefly to the treatment of cases and this was felt by many to be an inadequate method of dealing with the problem as cases which had been cured speedily became re-infected. Now, however, what Dr. Kendrick terms " soil sanitation " forms the first and most important part of the programme and this is undoubtedly the crux of the whole situation in Mauritius. It is clearly quite impossible for the Mauritian Government alone to undertake preventive and curative work of such magnitude. The cost would be prohibitive, and in any case I doubt if it would be possible to obtain the trained personnel required.

Importance of soil sanitation.

I have already asked that two Medical Officers from India be appointed for epidemic work, whose services in the intervals between epidemics could be utilised in connection with ankylostomiasis, but such a provision will only help in a minor degree. Hence it is fortunate that the Rockefeller Foundation is prepared to extend a helping hand. The conditions appear to me to be reasonable and indeed liberal. They are, I think, on the same lines as those which have formed a working basis for co-operation in other British Colonies.

Necessity for campaign.

As to the importance of ridding the labouring classes of Mauritius of a malady which retards development (Fig. 1), saps energy, renders its victims more liable to infection with other diseases, and which itself, when present in a severe form leads to total disablement and often death, there can be no doubt.

In this connection I submit an extract from a recent report by Dr. G. Baermann of Sumatra, where hookworn disease was one of the most important causes of invaliding amongst the coolies.

He states :—

Evidence from Sumatra.

'Three estates which, in spite of all recommendations, refused to adopt these measures (*vide infra*) had, in the course of the last 2½ years, 4,657 admissions to hospital. Three estates with the same labour force which did adopt these measures had 1,034 admissions showing a difference of 3,623.

'Assuming one admission comprises 22 days of treatment (average in 1918), reckoned at 50 cents a day, then this shows a loss of about 40,000 guilders for this period alone.

'The number of lightly infected (ankylostomiasis) coolies	
on insanitary estates was	310
on sanitary estates	20
The number of badly infected coolies :	
on insanitary estates	10
on sanitary estates	3

All sanitary estates show 1·8% of coolies sick.

Insanitary estates show 3·0% of coolies sick.

'I must not omit to once more repeat the important measures for combating ankylostomiasis.

(1) " The coolie lines must be clear of all cultivation for a space of 25 metres. (Rubber trees within this distance must be cut out or the branches pruned).

(2) " Floors of the rooms, verandahs and drains must be bricked and cemented and on the far side of the " drain " a border of 50cm. wide must also be of brick and cement.

" In the case of coolie lines built 2 to 4 feet above the ground only the space between the door and the drain need be cemented. The space under the floor should be surrounded with barbed wire or other form of fencing to prevent it being used in any way whatever.

(3) "All water tins must be placed in the cemented room on the verandah, or over the drain. They must not stand on the uncemented ground.

(4) " All coolie lines must be provided with a latrine built to a special design and, if possible, be connected with the coolie line by a covered way.

(5) " Each coolie line must have a good watchman, who must remove all weeds and wash down the drains and latrines daily.

(6) " Each assistant must inspect his coolie lines daily.

(7) " Very pale coolies should be sent to hospital for immediate treatment.

(8) " Regular worm cures according to the amount of infection which will be determined by an annual inspection of all coolies.

'By means of these measures during the period of 1906-1918, the number of first-class coolies has risen from 35 per cent. to 90 per cent. The number of medium infected coolies has fallen from 50 per cent. to 10 per cent.

'The number of severely infected coolies has fallen from 15 per cent. to 0·5 per cent.

I have, etc.,

ANDREW BALFOUR.

The Honourable
The Colonial Secretary."

Steps taken to improve conservancy methods.

In the meantime, being satisfied that Dr. Kendrick's severe strictures on the sanitary state of the Island were more than justified, as will indeed be evident from a consideration of the section of this Report devoted to conservancy, I endeavoured to get something done in connection with the latrine systems for sugar estates and schools, these being the places which most urgently required attention. It may be noted here that in a school at Quartier Militaire, Moka, Kendrick found 100 per cent. infection. Information and plans were furnished regarding the latest type of "Fuming Pit" or "Smoke Latrine" (Fig. 82) for the use of coolies on the estates and the simple and comparatively cheap Concrete Vault Sanitary Privy (Fig. 83) as recommended by the U.S. Public Health Service and which appeared to me very suitable for certain schools. (See also p. 84.) I am glad to say that several of the sugar estates agreed to instal trial fuming pits and before I left the Island I had the satisfaction of seeing one in use on the St. Hubert Estate, thanks to the interest taken in the matter by the Manager, the Hon. M. d'Unienville. It was functioning well, was freely used by a section of the labourers and appeared likely to be successful.

Introduction of fuming-pit latrines.

The only possibility of trouble lay in the fact that the level of the ground water being comparatively high at the spot chosen for the construction of the pit, the latter was not dry. As there was, therefore, some slight risk of contaminating neighbouring water courses which might possibly be used for drinking purposes, I recommended that cresol or chlorinated lime be systematically used as a disinfectant, and that, in future, places be selected where there would be at least 10 feet of soil in a vertical direction between the bottom of the pit and the surface of the water table.

Arrangements were also made whereby the Director of Agriculture would construct a trial fuming pit at Réduit. Unfortunately neither it nor those on the other sugar estates were completed before I left the Island, but I am hopeful that the method which is also mentioned on p. 84 will prove suitable and greatly diminish the risk of hookworm infection.

Experimental trial at schools.

The Colonial Secretary undertook to get the other method tried at some of the Government schools as it appeared to us important to get something done immediately, not only to combat the disease to some extent but to have useful data in readiness for the members of the Rockefeller Mission.

Rôle of pigs in the spread of ankylostomiasis.

Noting how pigs were allowed in many parts of the Island to roam at large I advocated their destruction in certain places on general sanitary grounds. It is, however, interesting to note that recently the rôle of the pig as a disseminator of ankylostome eggs has been established by the work of Ackert and Payne in Trinidad. It must, I think, be the case that these animals play a considerable part in the hookworm problem in Mauritius.

In addition to improved latrine accommodation and the safeguarding of water supplies I think something may be accomplished in the vicinity of dwellings and of existing insanitary latrines by the use of petroleum fire sprays. Firing the ground has long been known as a preventive method in ankylostomiasis, but as usually carried out it is troublesome and uncertain. With fire sprays, however, like those used by the Americans in their anti-malarial campaign at Panama, places presumably intensely infected could be speedily and effectively sterilized at a comparatively small cost. I had hoped that a supply of flammenwerfer from old war stocks might be available, but this proved not to be the case.

Value of fire-sprays.

Some powerful blow lamps were obtained locally, but they are cumbersome and heavy, and it will be better to obtain the real article.

Oil of chenopodium.

Oil of chenopodium is now generally regarded as the most satisfactory vermifuge in ankylostomiasis. It is interesting to note that the plant, from the fruits of which the oil is distilled, grows plentifully in Mauritius as a common weed. There it is known as Botrys, its scientific name being *Chenopodium ambrosioides* var. *anthelminticum.*

At my request, Dr. Tempany kindly made several distillations from the local plant but, unfortunately, the yield of oil proved low. Accordingly, in addition to placing the local plant under cultivation, he is obtaining from the U.S.A. some of the high-class seed for planting, and it is possible that from the resulting plants a satisfactory yield of oil of good quality will be obtained. There is some reason to think that growing *Chenopodium ambrosioides* var. *anthelminticum* on a large scale under scientific control might prove a remunerative step in Mauritius. The climate and soil appear well adapted to the plant and the oil is always likely to possess a considerable market value. Hence, as Dr. Henry, the Director of the Wellcome Chemical Research Laboratories in London originally suggested, a new and profitable industry might be established in the Colony. It may here be said that Mauritius appears to be well adapted for the growth of many kinds of medicinal herbs and trees, and that in view of the uncertainty as regards the future of sugar cultivation it may be advisable to consider what can be done in the way of encouraging the tillage, under scientific control, of drug-yielding plants.

Cultivation of chenopodium plant.

It is not, I think, out of place to mention the matter, for there will always be need of funds for sanitary purposes and anything which may tend to enhance the prosperity of the Colony should, for this reason alone, receive careful attention. At the same time, it is only fair to note that quite recently carbon tetrachloride has come very largely into use, and, it is possible, provided its value is established, that it may oust oil of chenopodium from the first place in anti-hookworm remedies.

Use of carbon tetrachloride.

BLACKWATER FEVER.

Blackwater fever.

This condition, for it is still doubtful if it is a disease *sui generis*, occurs in Mauritius, though it cannot be called common. In his Report on the outbreak of malaria at Phœnix, Dr. de Chazal recorded eight cases associated with the epidemic at Clairfond Marsh in 1907-08.

Incidence.

As is well-known, drainage of this swampy area completely banished the malaria and with it there disappeared the blackwater fever. This fact has indeed been advanced with good reason in support of the contention that blackwater is merely a special complication of malaria.

Historical enquiry.

I made enquiries as to whether blackwater fever had been known in the Colony before 1866, but could find no evidence that such was the case. It is, however, interesting to note that in the records of admissions to the Civil Hospital, Port Louis, from 1820 to 1865, bilious remittent fever figures to quite a considerable extent, and is noted as attacking Europeans, Creoles and Indians, but more especially the last-named, at least in the later years. Now what did this term connote? It is hard to say after the lapse of so many years. It cannot have been Bombay fever for that appears definitely to have been introduced in 1838, and cases of bilious remittent fever were fairly common in the twenties. The latter was said by Dr. Francis Reid, a former chief Medical Officer, *to be non-malarious* and to occur amongst all classes of the community. His description is somewhat vague but seems definitely to put blackwater fever out of account. It rather suggests some form of infectious jaundice, but is stated to have been non-contagious. Despite Dr. Reid's statement there is at least a possibility that it may have been malaria. If so, doubt would be thrown on the view that the introduction of *Anopheles costalis* in 1865 led to malaria becoming endemic in the Island.

Bilious remittent fever.

CEREBRO-SPINAL FEVER.

Cerebro-spinal fever.

This is known to exist, and during my visit an isolated case occurred in the Civil Prison, Port Louis. It is curious that, in the capital at least, the disease is not more in evidence for the conditions of overcrowding and lack of ventilation so favourable to its spread exist in no small degree. Possibly the climatic conditions are unfavourable. Still, sore throats and common colds are not infrequent, and these are generally regarded as predisposing factors.

The Registrar-General's report for 1920 gives 31 deaths from "meningitis," but there is nothing to show if any of these were due to the specific meningococcus. The disease is not mentioned in Anderson's "Epidemics of Mauritius."

CHOLERA.

Cholera.

There have been six epidemics of cholera in the history of Mauritius, the last outbreak occurring in 1862. The possibility of the introduction of cholera must always be borne in mind, and if the disease once gained a footing it would, under existing conditions, undoubtedly find every facility for its spread.

Considering the rôle of the carrier case and the close communication between the Colony and Ceylon and India, it is somewhat surprising that the Island has been free of infection for such a long period. Immunity in the past is, however, no guarantee of freedom in the future, and until the water supplies of Mauritius, and especially that of Port Louis, are improved, there must always be some anxiety on this score. Further reference to the subject will be found under the heading "Quarantine."

DIPHTHERIA.

Diphtheria

Diphtheria is not much in evidence at present, the deaths due to it in 1920 being given as 5, but it must not be forgotten that epidemics have occurred in the past and may occur in the future.

The conditions in the slum areas of Port Louis and Curepipe and in many of the wretched school buildings are favourable to its spread. I recommended that a supply of Schick's reagent should be obtained and kept in stock for use in emergencies (see p. 3 of second interim report), but it should only be used by someone fully trained in the method of its application.

DYSENTERY AND DIARRHŒA.

Dysentery.

Dysentery and diarrhœa, which may be classed together, are for the most part dirt diseases, and their prevalence in Mauritius tells its own story.

Amœbic commoner than bacillary.

Dysentery is one of the commonest and most important maladies in the Island, and as recently as 1920 formed the subject of an enquiry by a special committee, of which Dr. Barbeau, the Director of the Bacteriological Laboratory, was the president. The committee issued an excellent interim report, Appendix II., but did not state which of the two chief types of dysentery is the more common. Dr. Barbeau, however, informed me that the amœbic form was much more in evidence than the bacillary, though the latter exists. This is supported by the fact that it is only occasionally that dysentery assumes that epidemic prevalence which the experience of the war has shown to be characteristic of the bacillary form. The comparative frequency of liver abscess indicates to some extent the prevalence of amœbic infections.

Dysentery a notifiable disease.

At an early date I became convinced that it would be highly desirable to add dysentery to the list of notifiable diseases, not only to obtain, if possible, a more accurate idea of its prevalence, but to enable prompt measures to be taken for its prevention and cure.

It is perhaps too much to expect at present that the notification form should indicate the type of dysentery, but at a later date an effort should be made to secure such information. It is more valuable in the way of indicating proper treatment than methods of prevention, for the latter are the same in both amœbic and bacillary dysentery, but, on the other hand, the prophylaxis of dysentery depends largely on its efficient treatment, more especially when it is a question of getting rid of amœbic cysts. In this connection I would comment on the fact that, as a rule, the treatment of amœbic dysentery by emetine in the Government and sugar estates hospitals is inadequate.

Treatment of dysentery.

The courses of injections are much too short and in many cases patients must be discharged who are cyst-carriers capable of spreading infection. It is true that it is difficult to keep dysentery patients of the class treated in the above institutions in hospital once their symptoms disappear. They regard themselves as cured, and, disliking detention, clamour to be set free and even take French leave.

Still, the issues at stake are so important that every effort should be made to detain them and treat them thoroughly. As will be seen, there is much need for a general improvement in hospital discipline.

Faulty dietary in dysentery.

Another point to which I must refer is the wholly unsuitable dietary which is prescribed in the sugar estates hospitals for cases of dysentery and diarrhœa. What is termed "ordinary diet" is ordered and consists of salt fish and dhall, rice, ghee or oil and salt. Occasionally milk is ordered as an extra, but this is by no means invariably the case. I was informed that this diet is given for reasons of economy. I can only say that such economy is not only false, but inhumane.

The matter was reported as soon as the discovery was made, and I trust it has now been remedied.

Intestinal schistosomiasis.

A question which remains undecided is the existence or non-existence of intestinal schistosomiasis, a condition which frequently causes dysenteric symptoms. One of the sugar estate dispensers who was trained in microscopic work assured me that he had found the lateral spined eggs of *S. mansoni* in the stools of patients, but apparently there is no other record, possibly because attention has not been sufficiently directed to the matter.

It is, I think, quite possible that intestinal schistosomiasis occurs in Mauritius, and that it may account for some of the cases of dysentery. The matter requires investigation.

Diarrhœa.

Flagellate diarrhœa is not infrequent, and *Lamblia* (*Giardia*) *intestinalis* and *Trichomonas intestinalis* have been identified. The prevalence of pigs in many parts of the Island and the manner in which they come into close association with the lower class Indians and Creoles makes it almost certain that "Ciliate" dysentery due to *Balantidium coli* exists. So far it has not been recognised.

Enteritis.

Attention was drawn to the prevalence of Enteritis in Port Louis and to the fact that the term connotes chiefly the infective diarrhœa of infants and young children, a condition due to insanitary surroundings and faulty feeding. It appears to be common throughout the Island. The Registrar-General records 308 deaths from this cause during 1920.

ENTERICA.

Enterica.

The Army term is here used and includes typhoid fever and the closely related paratyphoid infections. These were considered, so far as Port Louis is concerned, in the second interim report. Typhoid fever, infection with which in Mauritius had occasionally been traced to polluted shell-fish, is in all probability much more common than is indicated by the official returns and there can be no doubt that it is frequently mistaken for malaria, the disease which in the tropics it most closely resembles.

The facilities for its bacteriological diagnosis are practically limited to the laboratory at Réduit. In order to aid the staff there in dealing with the specimens sent to them I have suggested that a Garrow's agglutinometer be obtained, a useful instrument when a large number of tests has to be carried out in a limited time.

At the hospitals the clinical "Atropine test" introduced by Marett might with advantage be employed.

Paratyphoid fever.

Of the paratyphoid infections Dr. Barbeau has found Paratyphoid A. the most frequent, but he informed me that he does not regard paratyphoid as at all common.

He speaks, of course, from experience, but I cannot help thinking, as a result of what is known to occur in other countries, that a careful enquiry would show that paratyphoid infections are far from infrequent.

Use of "triple" anti-typhoid vaccine.

In any case Dr. Barbeau has agreed that it would be well for his laboratory to issue in the future triple vaccine instead of the anti-typhoid vaccine at present supplied. The latter is largely used especially by the better class population resident in the Plaines Wilhems District, and this in itself is, to some degree, an acknowledgment of failure in sanitation. Anti-typhoid inoculation should, in times of peace and amongst a civilian population, be merely an auxiliary method instead of usurping first place in the line of defence.

Possibility of infection with *B. fæcalis alkaligenes*.

In view of what was discovered in Egypt during the war and in the light of Duke's observations in Uganda, I think it is very necessary to find what part *Bacillus fæcalis alkaligenes* plays in enteric disease in Mauritius. This organism is the cause of a fever so closely resembling typhoid that they cannot be distinguished save by laboratory tests. It may well be that some of the obscure cases of fever which have hitherto baffled both the clinician and the bacteriologist are due to this cause. I have asked Dr. Barbeau to give the matter his attention.

FILARIASIS.

Filariasis.

The number of cases of filariasis and elephantiasis treated during the last few years, *i.e.*, 1916-1920, in the Port Louis Civil Hospital and Dispensaries was obtained. The returns are incomplete, but 63 cases are recorded in which apparently infection was locally acquired. We know very little about the incidence and distribution of filariasis in the Colony. Long ago Grandpré and d'Emmerez de Charmoy showed that in Mauritius, as elsewhere, *Culex fatigans* is a vector of *Microfilaria bancrofti*, but it is quite possible that other species of Mauritian mosquito are operative. For example, there is *Stegomyia scutellaris* (*albopicta*), which is very wide-spread in its distribution and which is known to be effective in Malaya, while on the West Coast of Africa *A. costalis*, so common in Mauritius, has been proved to carry filariasis.

Mosquito vector.

The disease is favoured by a high temperature and a high relative humidity, and hence is probably most common in the coastal areas and in low-lying valleys between the hill ranges, like those which occur in central Flacq.

Filarial fever.

Filariasis may be associated with fever and hence may be confounded with malaria and other diseases. There is great need for a thorough enquiry into its incidence while for its diagnosis the use of the microscope is essential.

INFECTIOUS JAUNDICE.

Infectious jaundice.

I can find no record of the occurrence of this disease, now better known as *Spirochætosis icterohæmorrhagicæ*, in Mauritius, even under its old name of Weil's Disease. I mention it because the condition is not unlike bilious remittent malaria and blackwater fever and it would be useful to know if it is present in the Colony. Wild rats form the reservoir of the parasite and I asked Dr. Barbeau to examine some of these rodents from Port Louis for the specific spirochæte. He did so with negative results, but the examinations were limited and further investigations are required.

INFLUENZA.

Influenza.

The terrible epidemic of this disease, which in 1919 killed more than 11,000 people, had left its usual sequelæ of damaged lives. The Island had not fully recovered from its dire effects which, both from a medical and economic standpoint, had been very serious. Not only so, but during my visit there were a number of limited outbreaks of influenza, more especially in Flacq and Pamplemousses, which, though not so severe as the great epidemic, yet took toll of many lives.

Predisposing causes.

The spread of influenza is favoured by the bad housing conditions amongst the lower classes and by the habit, common both to Indians and Creoles, of shutting air and light out of the sick room.

Many persons suffered without any medical attendance whatever, and the conditions generally were highly unsatisfactory.

Attention was accordingly directed to the new, simple and cheap prophylactic measure which Dr. J. A. Taylor, of the Uganda Medical Service, had used with satisfactory results.

Treatment by the iodine method.

It consists in adding together equal parts of ordinary tincture of iodine (B.P.) and native honey. Two or three drops of this mixture are placed on the tongue of contacts at least every three hours throughout the day. At a later period the use of iodine intravenously was advocated for treatment, either by the method of Stokes, which consists in the administration of sodium iodide and sodium salicylate in 15 grain doses dissolved in 20 c.c.

of water, or by giving 20-30 minims of the B.P. tincture of iodine diluted with 9 c.c. of 0·85 per cent. of salt solution or by the employment of liquor iodi in from 40 to 80 minim doses.

The Medical and Health Department circulated the information with a request for reports on the results observed. These had not been received at the time I left, but one Medical Officer informed me that he had found both the prophylactic and curative methods of value in his hospital practice.

It is to be hoped they will be given a thorough trial, for influenza and its sequelæ are a fruitful source of illness and death in the Island.

LEISHMANIASIS.

Leishmaniasis.

As noted by Ross and other observers, it is an interesting and surprising fact that Kala-azar has never been encountered in Mauritius. Considering the large number of Indian immigrants in former years, some of whom must have come from localities in which the disease exists, it is remarkable that it has never been reported in the Colony. It is, of course, possible, indeed probable, that cases have occurred and have not been recognised, but if this be so one is constrained to ask why the disease has not spread and forced itself upon the attention of medical officers and local practitioners. Dr. Barbeau, who is familiar with its causative parasite, has looked for the latter in vain, and there is nothing to indicate that any form of Leishmaniasis has gained a footing in the Island. The same thing is true in Natal, the West Indies and British Guiana, and a study of this subject in Mauritius might throw light on the still obscure etiology of the condition, at least so far as Kala-azar is concerned. It is conceivable that some insect vector present in India and other endemic centres of the disease is absent in Mauritius and those other countries to which cases must almost certainly have been introduced from time to time but in which the malady has failed to establish itself. I had little time to enquire into the matter but I saw no example of splenomegaly suggesting invasion by *Leishmania donovani*, while oriental sore appears to be conspicuous by its absence. At the same time there is great need for a scientific study of the cutaneous ulcers which are so common and the nature of which remains frequently undetermined.

No evidence of its presence

LEPROSY.

Leprosy.

Special attention was directed to leprosy and the measures taken to deal with it. The latter were found to be hopelessly antiquated and inadequate. The leper asylum at St. Lazare is a disgrace to the Colony. So long ago as 1879 Dr. Davidson described it as being very defective in its buildings, rules, sanitary arrangements and medical supervision, and stated that it is situated in so unhealthy a locality that it would not be desirable to expend money upon its improvement. This advice appears to have been acted upon, but his recommendation that a new leper asylum be provided was ignored even though a special Leper Commission in 1887 supported his contention. Its report indicated :—

Leper Commission, 1887.

(1) That only one hospital existed in the Island for lepers, and that it was badly situated, right in the very centre of an extensive breeding-nest of anopheles (the situation could not have been worse);

(2) That the public hospitals did not admit them, and the prisons and lunatic asylum retained them only as long as was absolutely necessary;

(3) That compulsory segregation was the most effective means of checking the spread of the disease;

(4) That no Government relief should be given to those outside the Hospice of St. Lazare;

> (5) That a law should be passed compelling lepers to enter that institution;
>
> (6) That intermarriage of lepers be forbidden, so as to prevent the hereditary taint. (It is now known that there is no evidence of the latter.—A.B.).
>
> (7) That no leper immigrant or alien be allowed to land in the Colony;
>
> (8) The necessity of the introduction of the Contagious Diseases Act;
>
> (9) That a new Lazaret in a healthier locality, supported entirely by Government and staffed by Government officials, be at once constructed.

Commenting on its findings, Anderson says :—

> "Of all these resolutions passed in 1887 the only one that has been put into effect is the prohibition of Government relief outside the Hospice St. Lazare. None of the other resolutions have, until this date (twenty-eight years after) been put into execution. This is cruel negligence on the part of the authorities. . . . . ."

Prevalence of leprosy.

In Davidson's day there were 762 known lepers in Mauritius, of whom 340 were paupers, and of the latter about 240 were inmates of St. Lazare.

At the time of my visit the patients in St. Lazare numbered about 50, but it is known that there are many other lepers in the Island, and, indeed, I visited a Chinaman in an advanced stage of the disease in the vicinity of the hospital. Ordinance No. 39 of 1882, which is still in force, provides only for the detention and treatment of convict, vagrant and pauper lepers.

St. Lazare Leper Asylum.

I found St. Lazare very much in the same condition as it was in Davidson's time. The male section was much worse than the female, and the male patients come and go as they please and are permitted to fashion small brooms from grass which, without disinfection, are sold to the public (Fig. 2). It need hardly be said that an article of this kind which may be made by a leper whose fingers and hands are ulcerated and discharging is very likely to be a source of danger.

New leper hospital, Powder Mills.

In a special Memorandum 35/R/14 of April 22nd, 1921, which was printed as an Appendix to my second interim Report, attention was drawn to the matter and Sir Hesketh Bell's scheme of removing the lepers to Powder Mills in Pamplemousses (Fig. 3) approved, although it was pointed out that Powder Mills was not an ideal place for a leper hospital. At the same time, when properly fitted up for the accommodation of lepers and placed under efficient medical control it will be a great improvement on St. Lazare.

Leprosy a notifiable disease.

The whole question was discussed with the Director, Public Works Department, who prepared plans of the dwellings, hospital wards and other buildings. It is very necessary that the work should proceed apace, that leprosy should be made notifiable, and that modern treatment should be introduced. Once the benefits conferred by the latter are apparent I have no doubt that many more cases of leprosy will reveal themselves and that it will be necessary to extend the scheme for Powder Mills.

Information has been furnished as regards the conclusions arrived at by the Conference of Leper Asylum Superintendents and others in India (1920), and also on the measures adopted and results achieved at the leper settlement, Makogai, Fiji. I hope very earnestly that the wretched state of the lepers in Mauritius will soon be improved and that every effort will be made to afford them the benefits arising from our greatly increased knowledge of how best to deal with the disease, both from the preventive and therapeutic aspects.

MALARIA.

Malaria.

So much has been written about malaria in Mauritius that it would be superfluous to say anything more regarding it, were it not that it is necessary to recount briefly what has been done in the way of giving effect to Ross's recommendations, to note the results which have been achieved and to indicate why these results have not been so good as it was at one time expected they would be. Moreover, owing chiefly to the fact that the greater part of my sojourn in the Island was during the non-malarial period of the year, certain aspects of the malaria problem came under notice which I believe throw a fresh light on the measures necessary for dealing with it and engender the hope that action taken on somewhat different lines than heretofore is likely to be followed by a large measure of success in eradicating both the disease and its mosquito vector. Frequent references to malaria will be found in the interim Reports, and in the first of these the conditions obtaining in and around Port Louis are discussed at some length together with the steps which, I think, should be taken to safeguard the town.

Statistics inaccurate.

No doubt it would be advisable to make malaria a notifiable disease all over the Island, but the expense would be prohibitive and, in any case, until facilities for microscopic examination are provided, the returns would not be reliable. As already pointed out, the malaria statistics at present are hopelessly inaccurate and there can, I think, be no doubt that the number of deaths attributed to malaria is considerably in excess of the actual figure. I am aware that such was not altogether the view of so distinguished an authority as Ross. In discussing the "Declared Fever Mortality," he states, that the fact that it is least in November and greatest in the autumn months is strong evidence in favour of the view that the fever returns in Mauritius are not as unreliable as might be supposed. "Had there," he says, "been very great error, the probability is that that error would have been equally distributed over all the months so that the known malarial seasonal variation would not have been so apparent."

Ross on "Declared Fever Mortality."

Later, he quotes Meldrum to the effect that an absence of seasonal variation was the characteristic of the total deaths in the Colony before malaria broke out in it. Doubtless, Meldrum was correct; Table 33 of his Report dated 1881, certainly appears to support his contention.

Seasonal variation.

A study of the Registrar-General's Reports for 1919 and 1920 shows that the deaths from "fever," termed, but erroneously termed, malaria and malarial cachexia, still show a seasonal variation, there being an increase during March, April and May(¹). There can be little doubt that this increase is chiefly due to malaria, but my point is that, throughout the year, there are in all probability a considerable number of deaths due to enterica returned as fever and classed as malaria. Possibly, some of the autumnal rise is due to these for autumn is the season when typhoid fever is apt to prevail. One cannot, of course, be certain, but it is curious that Ross does not consider the question of enterica, though he does speak of the slight summer rise due to dysentery and diarrhœa.

Spleen census.

In connection with the anti-malaria campaign which he instituted Ross laid great stress on the value of a spleen census though he admitted that in order to determine the endemic index, it is desirable to take both the parasite-rate and the spleen-rate.

He says that it is out of the question to consider determining the former for a large population. Hence he advocated the taking of a spleen census periodically with a view to finding out :—

(1) The localities most affected by malaria.
(2) The effect of preventive measures.
(3) The children who require treatment.

(¹) These are autumnal months in Mauritius.

He gave instructions in the method while in the Colony and framed a series of proposals as regards the investigations to be carried out both in schools and on sugar estates.

These were very comprehensive, were adopted and to a certain extent have been followed.

Faulty procedure.

I am quite certain, however, that Ross never intended that spleen palpation should be carried out *through the clothes.* Yet this is the slip-shod and unscientific method I found in vogue. In my opinion it reduced much of the spleen census work to a farce and I know at least one Mauritian doctor who shares my opinion.

Quinine distribution in Schools.

It is true that a markedly enlarged and hard malarial spleen can be felt even through several layers of clothing, but in the case of girl's clothing there are sometimes bands or hems, which, in a hurried examination, such as is conducted, may be mistaken for the spleen border. Moreover, even when long practice has developed a high degree of tactile sensibility it is, I fear, impossible to be certain as to slight splenic enlargements when one palpates through clothing, more especially if the spleen be comparatively soft. The matter is serious because, apart from the question of mere statistics, the distribution of quinine to school children depends on the results as does also the payment of bonuses to those schoolmasters, who, by giving quinine regularly, reduce the splenic indices of their pupils. At the same time it must be admitted that in many schools the quinine distribution is very unsatisfactory. In some schools I found it had been discontinued owing to carelessness on the part of the schoolmaster, in others it was given irregularly, and in yet others the rules as regards dosage had been disregarded. In one case I found a boy receiving much too large a dose of the drug. Everything depends upon the type of schoolmaster, and while some are attentive and take an interest in the matter, others neglect their duties.

Causes of tropical splenomegaly.

The method now followed will be described immediately. For the moment let us revert to the question of splenomegaly and the spleen census. Our knowledge regarding tropical splenomegaly has increased since the days when Ross made his recommendations. Even then he was careful to point out that the spleen-rate is not an exact measure of the amount of malaria present in a community. How inexact it is we are now beginning to realise, though it must still be accorded a certain value, at least in some places and with due reservations.

It may be argued that in the case of Mauritian splenomegaly the improvement frequently recorded after the use of quinine is a sure sign that malaria is the cause of the splenic enlargement. This, however, by no means follows.

Large spleens may diminish in size without any quinine being given, and in any case the records are not, in my opinion, reliable owing to faulty technique.

I admit that in Mauritius the presence of a markedly enlarged and hard spleen in a child under 16 years of age may, in the great majority of cases, be ascribed to malaria, but I am by no means so certain that the lesser degrees of splenomegaly, more particularly when the organ though increased in volume, is comparatively soft, can equally be attributed to the action of the plasmodium.

Malaria without splenomegaly.

Moreover, there can be no doubt that malaria may exist without any enlargement of the spleen. This has been shown to be true in the case of recent infections, in fact Ross duly notes it but, until recently, there has been no sufficient recognition of the fact that absence of splenomegaly is compatible with a correct diagnosis of malaria of some considerable standing.

In this connection I would direct attention to an interesting and important paper by Greval in the *Indian Medical Gazette* for March, 1921. His Summary and Comments may be quoted as they have a very direct bearing on the question.

Observations of Greval.

"During the months of July and August 204 cases came under observation for fever or enlargement of spleen or both. They could be classified as follows :—

"Twenty-six one-day fever. No enlargement of spleen. No parasite. No lasting effects. Treated symptomatically. No quinine given before, during, or after the attack.

"Only one patient returned with malaria within the following ten days (a case of new infection).

"All these cases could not have been cases of 'Abortive Malaria' or of 'Clinical Malaria,' in which the parasite could not be found.

"Seventy-eight positive cases of malaria :—

53 with enlarged spleen :
Approx. $\frac{2}{3}$ of the total.
25 with normal spleen :
Approx. $\frac{1}{3}$ of the total.

"Seventy-eight negative of the plasmodium or any other known parasite of the blood, but resembling malaria clinically. No quinine was given. Results obtained were more satisfactory than in the positive cases.

"Spleen was in :—

30 normal.
Approx. less than $\frac{1}{2}$ of the total.

48 enlarged.
Approx. more than $\frac{1}{2}$ of the total.

"Twenty-two cases of definitely non-malarial diseases in which the splenic condition abated with the abatement of the disease without quinine.

The incidence of spleen in cases that were positive microscopically (and cured by quinine) was certainly a little higher than in negative cases (not treated with quinine), but could not by itself establish a diagnosis of malaria in a case of 'fever' looking more or less like malaria (clinically).

"Taking all cases, febrile and non-febrile, the incidence of spleen was higher in non-malarial than in malarial cases.

"On spleen and its importance more could be said. During the year in four cases of death a post-mortem examination was considered necessary. Spleen was demonstrated to be enlarged during life. There were no other signs of malaria. In three a substantial diagnosis of a definitely non-malarial disease was established. The fourth was called malarial cachexia. Smears from the spleen (several) were negative in all four.

"People are known who develop an enlargement of spleen after a dose of a vaccine. A senior officer in the Indian Medical Service volunteered the statement to me concerning himself.

> "Going back to the one-day fevers (from which everyone suffers in the tropics, some time or other), they must be ultimately traceable to some virus (animal, vegetable or chemical), against which the majority of individuals have the power of quickly developing an immunity. Could not a certain proportion be lacking in that power and manage to harbour the infection for a longer time? The non-malarial enlargement of spleen (or an enlargement unconnected with any other known disease which has the reputation of enlarging spleen), could on a hypothesis like this be based on :—
>
> Possible causes of splenomegaly.
>
> (1) A chronic infection with an unknown virus.
>
> (2) Gastric derangements responsible for an atonic condition of the organ and its vascular system, involving spleen mechanically. The spleen so affected might in its turn interfere with the gastric mechanisms, thus establishing a vicious circle. Nearly half of the moderately enlarged spleens have a flabby attachment (atonic condition again). The use of hydrochloric acid and strychnine in curing the condition was based on these considerations."

Association of worm infections with splenomegaly.

Clonorchiasis and enlarged spleen.

Idiopathic splenomegaly.

I have always been inclined to think that, if carefully studied, some at least of the helminthic infections will be found associated with the lesser grades of splenomegaly.(¹) We know that in many instances this is certainly true of Clonorchiasis and this fluke disease occurs in the Colony. Indeed it was first discovered in Mauritius by MacGregor in 1874, but no one appears to have paid much attention to it. Possibly this is because the causative parasite was deemed harmless, a belief now known to be erroneous. Clonorchiasis, at least in its severe forms, is an important disease. It is likely that it was introduced from China and, as every facility for its spread exists, it is probably more widely distributed than is at present recognised. Apart from Greval's observations recent research has shown that there exist tropical splenomegalies, certainly non-malarial, but of which the cause has not yet been determined. There is, for example, the idiopathic splenomegaly of North Africa and the Philippines. Nicolle, of Tunis, has reported 172 cases of splenic enlargement in children where careful examination, including puncture, revealed the cause in 59 only. This splenomegaly is associated with anæmia and appears to be a distinct disease. It is quite possible that this condition occurs in malarious countries such as Mauritius and may, when reliance is placed solely on a spleen-rate, be mistaken for paludism.

It may be the same malady as that in which I believe Archibald in the Sudan has demonstrated a causative bacillus.

The spleen in rickets.

It must be remembered, also, that in children a pseudo-splenomegaly may be due to rickets. It was generally believed that severe rickets at least was always associated with enlarged spleen, but the work of Cowan, McClure, Hutchison and others has apparently demonstrated that this is not the case. In this connection Dr. Martin, of the Lister Institute, kindly put me into communication with Dr. Dalyell in Vienna, who informed me that her extensive observations there went to show that splenomegaly was undoubtedly rare in rickets.(²) On the other hand, as Trousseau long ago pointed out, the deformation of the chest may render the spleen readily palpable, and this is a matter deserving attention when carrying out a splenic index enquiry amongst children in a malarial country. I understand that cases of classical rickets are rare in Mauritius, but rickets occurs in tropical countries and there may be atypical forms of the disease difficult of recognition. The matter requires investigation, especially as malnutrition is common amongst children in the Colony.

As a matter of fact in the Registrar General's Report for 1919 eight deaths are attributed to rickets.

(¹) This view receives support in a recent paper by Jones on "Intestinal Bilharziasis in the West Indies" (*Jl. Tropical Medicine and Hygiene*, February 1st, 1922).

(²) Dick, in his recently published work on rickets, states that the spleen does undergo enlargement, but is not notably enlarged in uncomplicated cases.

Sufficient has been said to indicate that it would be better to replace the spleen census by systematic blood sampling, even though here again there are pit-falls. As Ross stated, the combined method of spleen and blood examination has many advantages. I agree, but, if adopted, the spleen census must be carried out in a very different manner to that which at present obtains.

Blood sampling.

For purposes of comparison it appears advisable to describe what is now done in the way of quininisation. Reference to Ross's report will show to what extent his recommendations have been followed, but, as already indicated, it must be taken with the proverbial grain of salt.

The following particulars were furnished me by Dr. Castel, and I have, of course, had an opportunity of seeing the process in operation:—

Quininisation.—Quinine is distributed in the Island in the following ways:—

Method of quininisation.

(1) A spleen census of all the children attending the Government and aided schools in the Island is made twice a year, and the head teachers are instructed to give to each child with an enlarged spleen or suffering from malaria a daily dose of quinine, varying according to age from 1 to 5 grains for five consecutive days in the week—the doses ordered to be given are those recommended by Ross, namely:—

From 1 to 3 years of age	...	...	1 grain.
,, 3 to 6 years of age	...	...	2 grains.
,, 6 to 9 years of age	...	...	3 grains.
,, 9 to 12 years of age	...	...	4 grains.
And ,, 12 to 15 years of age	...	...	5 grains.

A "bonus" of Rs. 10 every six months is given to the schoolmaster who obtains a spleen reduction of 50 per cent. amongst the children with enlarged spleens, placed under treatment as a result of the previous census.

(2) Quinine tablets of 1, 2, 3, 4 and 5 grains (as required) are deposited in every school, dispensary and police station all over the Island to be delivered free to all those who apply for quinine.

Quinine distribution.

(3) Four Dispensers are employed to distribute quinine from house to house. Formerly they were five in number and distributed the quinine in all malarious localities; but this proved a failure, for they had so much to do and such long distances to traverse that on an average each person treated only received one dose of the drug per month. Intensive comparative quininisation was then tried by making each Dispenser distribute quinine in two villages only; one where anti-malarial works had been carried out and the other where they had not, but this also failed to give satisfaction, either because the public refused to take the quinine or because the distributors did not do their best to persuade people to take it. Each person treated only received on an average two or three doses of the drug per month and the spleen rate only decreased in those places where anti-malarial works had been executed.

Since July, 1920, four Dispensers only have been employed. They distribute quinine solely in villages where anti-malarial works have been carried out.

Dr. Castel tried the effect of giving a bonus to the quinine distributors, and he remarks that it was apparently successful in the villages of Pamplemousses, St. Croix and Vallée des Prêtres, to judge by the reduction in spleen rate which occurred.

It is difficult, however, to say how much the improvement was really due to the anti-mosquito measures which have been extensive and well devised.

Failure of method.

From what I have seen and heard I am convinced that, while possibly for a time, Ross's recommendations as to spleen census and quininisation were faithfully carried out and did good, there has been with the lapse of years a waning in enthusiasm and, owing to local difficulties of all kinds, a lack of efficient control and supervision, which have rendered these measures to a large extent both useless and wasteful. It is not easy to be quite certain but such is my impression.

Quinine therapy.

In any case I doubt if quininisation *on a large scale* is an anti-malarial method which can be employed with advantage in a place like Mauritius. As James has pointed out, it is a mistake to dissipate energy in fighting malaria. and it is probably better to stick to one measure and carry it out thoroughly than to try several at the same time, for, then, one or other is apt to suffer from inadequate application. At the same time where a careful quinine therapy can be put into practice its value cannot be doubted, and it may be employed with advantage under adequate medical control.

Routine method of Bass.

By careful quinine therapy is meant an administration of quinine for curative purposes on sound scientific lines. Unfortunately, views on this subject are still conflicting, but, everything considered, the best routine system of treatment is probably that introduced by Bass in the U.S.A. and adopted by the National Malaria Committee. It has stood the test of time, and though it will not give perfect results it will cure the majority of cases at least temporarily and disinfect a considerable percentage of them. Bass claims rather more for the method, but it is well to be conservative in the matter. The treatment is as follows :—

> "For the acute attack 10 grains of quinine sulphate by the mouth three times a day for a period of at least three or four days (better, I think, for a week or 10 days when it can be managed) to be followed by 10 grains every night before going to bed for a period of eight weeks."

Quinine sulphate in acid solution.

In this connection I would refer to the fact that, everywhere in Mauritius, I found quinine sulphate being given without acid. I endeavoured to get this erroneous method of administration changed. I see that in a recent paper Acton says :—

> " The mono-salts—*e.g.*, commercial sulphates—should always be given with acids, as they use up the free HCl in the stomach, and thus further inhibit peptic digestion.
>
> " In pill form the bihydrochloride or bisulphate should always be prescribed."

House protection

Ross in his report devoted a few paragraphs to House Protection. He termed it a " prospective vicarious measure," and it may be said at once that very little has been done in this direction chiefly on account of the high cost of wire netting in Mauritius.

Apparently the only buildings fitted with mosquito gauze were the Royal Alfred Observatory in Pamplemousses, the Central Prison at Beau Bassin and the now defunct Plague Hospital in Lower Plaines Wilhems.

At the Observatory I found the netting had fallen into disrepair. It was worse than useless, converting the place into a mosquito trap.

The Director had again and again asked that it be put in good order, but nothing had been done.

Mosquito-proofing of police quarters.

I recommended that the work be put in hand at once, and, as a result of inspections, suggested that it would be advisable to mosquito-proof the police quarters at Bambous and Rivière Noire Post in the Black River District. Indeed, I feel very strongly that it is the duty of the Government to protect its servants from malaria infection in all dangerous parts of the Island. In most localities the police quarters are good buildings which lend themselves to mosquito-proofing and, pending a more intensive anti-mosquito campaign, it should be the rule to render these places as safe as possible. Looking at the matter merely from the standpoint of economy it would pay in the long run to do so, for there is much sickness amongst the police and the present policy is alike foolish and wasteful.

Long ago Ross spoke of Poste de Flacq as a spot where house protection should be tried. Nothing has been effected and I agree with him that it should be done for reasons stated on page 7 of my fifth interim report.

Mosquito reduction.

The last of the principal measures advised by Ross and the one on which he laid the greatest stress was *Mosquito Reduction.*

It may be said at once that when I visited the Island the position as regards our knowledge of the Mauritian anophelines and their relation to malaria had not altered.

Mosquito vectors.

In other words *Anopheles costalis* remains the principal and probably the only vector. *A. mauritianus* is still regarded as playing no part in the transmission of the parasite in Mauritius, though it is worth noting that, in other countries, Edwards records it as a poor carrier of malaria. As a matter of fact the only positive record I can find regarding the full development of the plasmodium in this species is that by Christophers quoted by Theobald to the effect that in Sierra Leone in 1900 on two occasions sporozoites were found in the salivary glands. (A New Anopleles (*A. paludis*) from Sierra Leone. Theobald. Reports to the Malaria Committee of the Royal Society, 1900.)

The third and last Mauritian anopheline *A. maculipalpis* appears to be at least as rare as it was in Ross's time. I never came across its larvæ. The places where it was found breeding by Fowler, *i.e.*, at the Fanfaron Bastion, Port Louis and Clairfond, near Phœnix, were long ago abolished. It is possible that this species has ceased to exist on the Island.*

Relation of *A. costalis* larvæ to shade.

But though our knowledge with respect to the mosquitoes themselves has not altered, that regarding their habits has changed in one important particular. As this has a bearing on what has been done to give effect to Ross's recommendations, it may here be mentioned, though it involves other questions better considered perhaps in connection with general sanitation. It was found, I understand by Dr. Castel, who of late years has done more in the way of malaria prevention than anyone else in Mauritius, that the larvæ of *A. costalis* are not found in shady places partly because in such spots the green alga on which they feed does not grow. Dr. Castel demonstrated this fact to me again and again, and, in any case, being very familiar with the habits of *A. costalis*, a common African anopheline, I was aware of its liking for water-courses in the full blaze of the sun.

At the same time I did not fully appreciate how it avoided shade until Dr. Castel drew my attention to the matter. It is interesting to note that Wenyon found the same thing true of *A. superpictus* in Macedonia.

River Reserves.

Now this bears an important relation to the question of " River Reserves," those strips of jungle frequently composed of jamrosa trees (*Eugenia jamrosa*)

---

* Advices recently received from Mr. M. E. MacGregor, the Entomologist now working in Mauritius, show that this Anopheline is more common than was supposed, at least in the Port Louis district. Its larvæ closely resemble those of *A. mauritianus*.

(Fig. 26) which border the streams and rivers. Both Ross and Fowler in their reports discuss "River Reserves" and their possible association with malaria, but, so far as I can ascertain, the peculiar effect of shade upon *A. costalis* had not then been noted. At the same time Ross states that Mr. Koenig pointed out to him that *grass* does not grow well in streams shaded by large trees, and, after weighing the matter carefully in all its aspects, he issued the well-considered opinion expressed on p. 144 of his report.

The whole question of "River Reserves" was referred to me and the following memorandum which I addressed to the Colonial Secretary on September 27th, 1921, will indicate the conclusions at which I had arrived from a study of the local conditions.

Recommendations regarding river reserves.

"On September 22nd I attended a meeting of the River Reserves Board, where the whole question was discussed from an anti-malaria, a sanitary and an economic standpoint. As a result it seems to me that:—

(1) The Government should take the River Reserves into its own hands. In other words, there should, where necessary, be expropriation of the planted areas. The total area planted is 6,000 acres.

If this is done, the riparian owners might be given pre-emption so far as obtaining felled trees is concerned, but the felling should be done solely by the Woods and Forests Department.

(2) The riparian areas which were cleared and placed under sugar cane should be turned into river reserves. In many cases the leases are expiring and I am told that the change could easily be effected by means of an Order in Executive Council.

(3) The margin of the original bed of any river or stream should be considered as constituting the riparian boundary in judging the extent of the reserve.

I found that all the members of the Board were agreed on the necessity of adopting these recommendations and from such experience as I have gathered in the course of my inspections and as a result of discussing the matter I find myself in full accord with the opinion of the Board. In addition I may say that I agree with the regulations already laid down as regards the breadth of the river reserves, *i.e.*, 10, 25 and 50 feet respectively, according to the size of the water-courses. From an anti-malarial standpoint 20 feet is no doubt sufficient, but there are the sanitary and forestry points of view to be considered, and therefore for large rivers a breadth of 50 feet is certainly desirable."

It scarcely seems necessary to enter more fully into this question. It is true that the reserves may afford shelter to adult anophelines, but, if cleared of brushwood, they are not likely to be sources of real danger, and I believe their advantages outweigh their disadvantages.

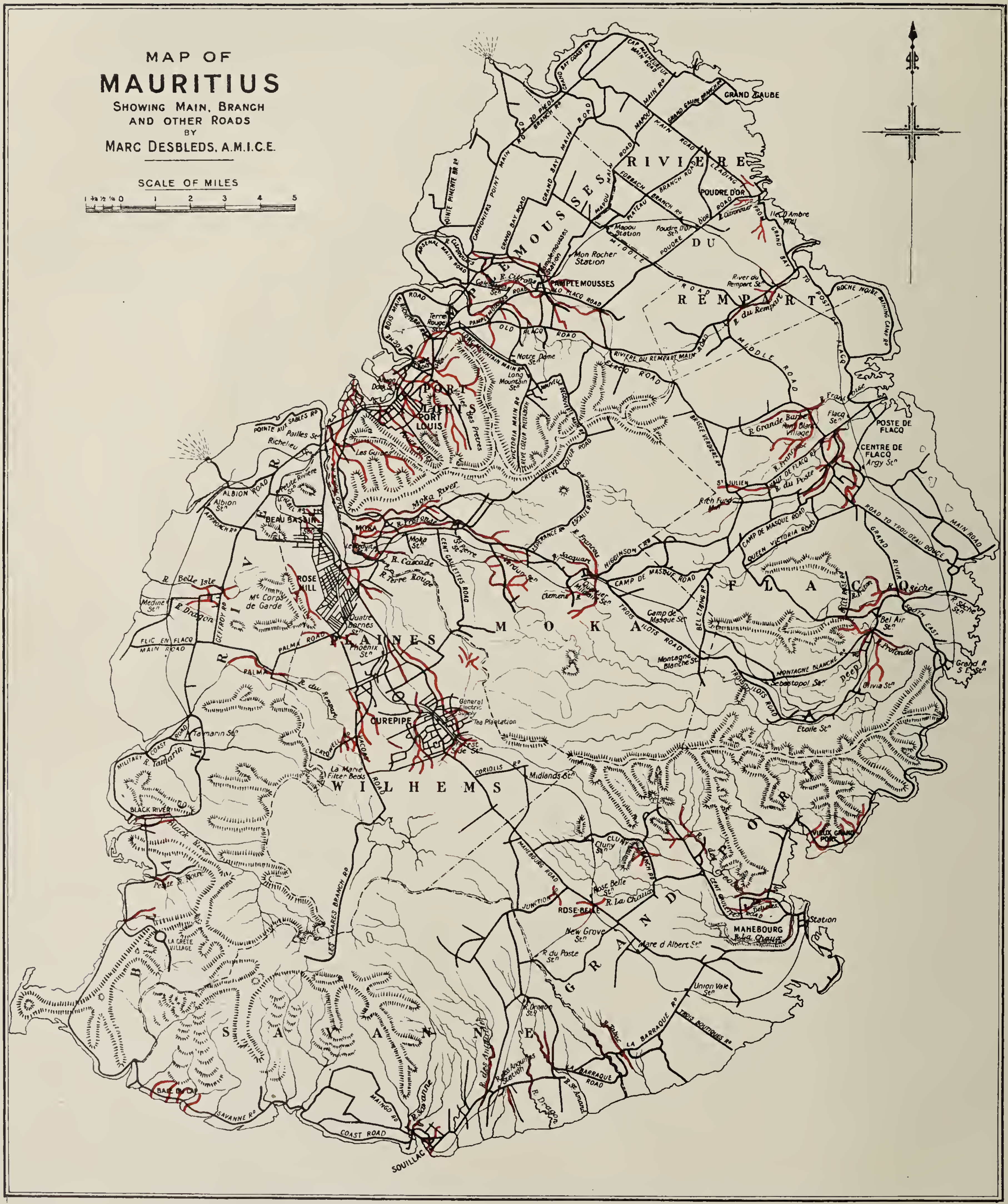
At present the control of river reserves is vested in a Board consisting of the Director of the Medical and Health Department and the Director of the Woods and Forests Department. The Acting Chief Sanitary Officer supervises the actual work and has two inspectors under him. This Board was established on the recommendation of a special committee, whose report will be found in Appendix III.

The operations comprise the prevention of tree-felling in the riparian areas and the re-stocking of the Reserves with suitable trees.

Anti-mosquito measures.

The reader is referred to Ross's report for full details regarding his recommendations with reference to mosquito reduction, but a brief summary is here given which can be compared with the measures now in vogue.

MAP II.



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The red lines show approximately the amount of anti-malarial work carried out in connection with the training & canalisation of streams & rivers & the drainage of swamps. (After Dr L. Castel).

1. Minor works as follows :— Minor works.

(*a*) Keeping clear of weeds and other obstructions, built street gutters and surface drains (Figs. 15 and 23).

(*b*) Clearing of weeds, levelling and discharging roadside ditches and channels.

(*c*) Keeping made water channels clear of weeds and pools.

(*d*) Removing grass, weeds and pools from the margin of ponds and streams, and rough canalisation of the latter (Fig 21).

(*e*) Discharging, filling or deepening surface pools where practicable.

(*f*) Discharging leakage from standpipes.

(*g*) Filling or oiling certain pits.

(*h*) Concreting hollows in rocks and holes in trees.

(*i*) Cutting undergrowth.

(*j*) Dealing with house waters and other useful work in spare time, especially in the cooler and drier non-malarious season.

REQUIREMENTS.

(i) Workmen, 376 in all. To be reduced later. Salaries = Rs. 5,450 per mensem. This includes 49 workmen for estates.

(ii) Moustiquiers. Thirty-one in all. Salaries = Rs. 4,560 per mensem. This includes the 16 moustiquiers for estates.

(iii) Officer known as the Malaria Authority for whole-time work and provided with clerk and office.

(iv) Legislation for facilitating works.

(v) Certain administrative adjustments.

2. Major works to be commenced after a trial of the minor works and consisting of the clearing and drainage of marshes, training of streams and rivers, canalisation of streams, filling up of ponds, etc. Major works.

REQUIREMENTS.

(i) 205 workmen with 18 sirdars for upkeep. Salaries = Rs. 42,300.

(ii) A capital expenditure of Rs. 630,000.

(iii) An annual recurrent expenditure of Rs. 44,300.

3. An annual Malaria Report. Annual Malaria Report.

Very considerable activity was displayed after Ross's visit, and as the minor works failed to accomplish the end in view, recourse was also had to major operations.

Map II. shows in red the areas where streams, rivers, ponds and swamps have been dealt with, while in Appendix VI.,* which I owe to Dr. Castel, are indicated fully—

(*a*) The detailed recommendations made by Ross.
(*b*) Those which have been carried into effect.
(*c*) Those which still require execution.
(*d*) Additional works accomplished.

These operations have been conducted by Government, largely under the supervision of the Malaria Authority, who, however, far from being the whole-time officer suggested by Ross, at the present time at least combines 'Malaria Authority not a whole-time officer.

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* It is to be regretted that, owing to its length and also to the fact that discrepancies were found in it which could not be corrected in this country, Dr. Castel's tables could not be included. In any case they had to be hurriedly prepared and unfortunately he had no opportunity of revising them.

in his person the duties of Malaria Authority, Chief Sanitary Officer and Sanitary Warden for the northern part of the Island.

So far as major works of a permanent character are concerned, the Director of Public Works and Surveys is responsible, as such works require special knowledge of engineering. When they are completed they are handed over to the Medical and Health Department in order to be upkept.

Responsibilities of Port Louis Municipality and of Local Boards.

In addition to the above it must be noted that in the urban area of Port Louis the Municipality is responsible for all major and minor anti-malarial works, while in the cases of Beau Bassin - Rose Hill and Curepipe (Plaines Wilhems), in Rose Belle and Mahebourg (Grand Port) and in Rivière Seche, Central Flacq and St. Julien (Flacq), the responsibility rests with Local and District Boards, the work in all cases being supervised by the Sanitary Warden of the district. This arrangement is a fruitful source of trouble, as dual control is always apt to be in work of this nature. At the same time in certain places it may be justifiable where a Local or District Board shows itself keen and energetic and is willing to follow the instructions of the Government Sanitary Officer. Such a happy state of affairs, however, appears to occur but rarely in Mauritius.

Owing to changed conditions it is impossible to institute an exact comparison of the measures now in force and those recommended by Ross, but it may be stated, thanks to information supplied by Dr. Castel, that the following personnel is employed :—

(1) A number of day labourers, engaged as required and working under moustiquiers and trained sirdars. They are known as improvement gangs.

Existing staff for anti-malaria work.

(2) One chief moustiquier, known as a junior assistant, two head moustiquiers, one senior moustiquier and 23 ordinary moustiquiers, who are divided into five classes according to length of service and the importance of the sections of which they are in charge.

(3) Roughly, 236 cantonniers.

Considering now the work and pay of these different units, we find that :—

Duties of staffs.

(*a*) The improvement gangs who form a special charge of the chief moustiquier are engaged in clearing out and repairing streams, canals and drains after floods. During the dry season they fill up pools, drain marshes and train streams. Each sirdar or foreman receives Rs. 1·50 to Rs. 2 per diem, plus Rs. 0·05 cents per man and Rs. 0·02 cents per boy or woman working under him. The labourers are paid according to the current scale of wages, which is very much higher than in Ross's day.

Whenever possible they are given piece work. The number of gangs and of men in each depends upon the funds available, but a permanent section is maintained for dealing with conditions after floods.

Work of this kind is estimated at about one-third the total cost of upkeep.

(*b*) The post of chief moustiquier was abolished in 1920, but the duties of the post are performed by the junior assistant appointed in 1918 by the Governor to assist the Sanitary Warden North.

He has charge of the improvement gangs and supervises all improvement and new works. His salary, including war allocation, is Rs. 160 *per mensem*, with a monthly travelling allowance of Rs. 40.

Of the two head moustiquiers, one looks after the four northern districts and the district of Port Louis, the other is responsible for the three southern districts and the district of Black River. They supervise the upkeep of anti-mosquito work, search for mosquito nurseries and report to the Sanitary Wardens. Salary, including war allocation, Rs. 96 *per mensem*, with a monthly travelling allowance of Rs. 50.

The senior moustiquier is expected to search for mosquito-breeding places in towns, village and populous places in the districts of Plaines Wilhems, Grand Port and Savanne, and to report his findings and the action he takes to the Sanitary Warden. Salary, Rs. 52.80, including 60 per cent. war allocation.

Scope of work.

Each of the ordinary moustiquiers has charge of a section in a district and is responsible for the satisfactory upkeep by the cantonniers of all streams, drains and canals in that section. He has also to report any mosquito nuisances discovered in his section. If a cantonnier has neglected his work the moustiquier can employ extra labour to put matters right, the cost being charged to the cantonnier, and the Sanitary Warden or the Chief Sanitary Officer has power to fine the moustiquier if he has been remiss and to engage extra labour at his expense to remedy faulty conditions due to his neglect.

Salary varies from Rs. 35.20 to Rs. 52.80 *per mensem*, including 60 per cent. war allocation.

Method of work.

(*c*) Each cantonnier is in charge of a certain number of feet, termed a "block" of a river, stream, drain or canal which it is his duty to keep clean and free of mosquito larvæ. As stated above, if he fails to do so the moustiquier can take action, a line of policy introduced by Sir Hesketh Bell several years ago, which is said to have proved highly satisfactory.

Salary, including war allocation, varies from Rs. 16 to Rs. 32 *per mensem*, according to the amount of work.

The following notes and table compiled by Dr. Castel at my request will be found instructive.

For the quarter ended the 31st March, 1921, these 23 moustiquiers and 236 cantonniers upkept 1,403,842 feet of treated water-courses at a cost of Rs. 24,084.77, or 266 miles for Rs. 96,339.08 for a whole year, that is, Rs. 362.14 per mile per year, or about Rs. 0.99 per mile per day.

Details of work.

In some districts the cost of upkeep is much higher than in others; for instance, whilst in Port Louis it is only Rs. 0.68, in Black River it amounts to Rs. 1.67 per mile per day (*vide* table below). This depends upon the distances of the treated streams from one another, but principally upon whether the stream that is being upkept has been simply cleared, roughly trained or thoroughly canalized, etc.; the more thoroughly a stream has been canalized the less costly is its upkeep.

District.	No. of Moustiquiers.	No. of Cantonniers.	No. of feet upkept daily.	Cost of quarter ended 31/3/21.	Total cost per year.	Cost per mile per year.	Cost per mile per day.
				Rs.	Rs.	Rs.	Rs.
Port Louis...	2	23	207,674	2,428.80	9,715.20	247 01	0.68
Pamplemousses	3	33	203,155	3,297.12	13,188.93	342.73	0.94
Rivière du Rempart ...	1	5	26,610	561.60	2,246.40	445.71	1.22
Flacq	2	32	163,732	2,966.40	11,865.60	382.64	1.05
Plaines Wilhems	4	36	281,747	3,840.66	15,362.64	288.93	0.79
Moka	4	52	276,553	5,616.00	22,464.00	428.87	1.18
Grand Port	4	25	145,757	2,659.19	10,636.76	385 25	1 06
Savanne	1	11	40,642	1,037.00	4,148.00	538.70	1.61
Black River	2	19	57,972	1,678.00	6,712.00	611.21	1.67
Whole Island	23	236	1,403,842	24,084.77	96,339.08	362,14	0.99

---

* Appendix V, which contains Dr. Castel's figures, could unfortunately not be included in this report for the same reasons which necessitated the exclusion of Appendix VI. Both his sets of figures are, however, in the possession of the Colonial Office.

In addition to the forces mentioned the Sanitary Inspectors of the Medical and Health Department are supposed to render assistance. In some instances they do so but they are not infrequently ignorant of mosquito work, or, even if they can recognise larvæ and pupæ, take little or no interest in their suppression. For example, I found that the Sanitary Inspector of the Black River District, the most malarious part of Mauritius, was unable to recognise anopheline larvæ. Yet he had been 28 years an inspector and spent 12 years in the Black River District. He told me that he did not consider anti-mosquito work as part of his duties!

Dr. Castel furnished me with the following summary of the general scheme of operations now in force.

> " (1) Slowly running marshy streams with numerous large pools in them are canalized and their gradients corrected. (Fig. 32.)
>
> (2) Marshes are drained, some by circumvallatory and others by herring-bone drains discharging into a main central channel. Some of the drains are open, others rubble and others again underground or covered, to suit the requirements of each case. (Fig. 33.)
>
> (3) Pools, hollows, quarry pits, etc., liable to hold water long enough for mosquitoes to breed out are filled up, or partly drained and partly filled up according to circumstances.
>
> (4) Road-side gutters in which water runs continuously or long enough to breed mosquitoes are improved and levelled.
>
> (5) All treated water-courses are maintained and kept as free from weeds and mosquito larvæ as possible. (Fig. 24.)
>
> (6) Notices are served on the Municipality, the Local Boards and owners of private premises to abate all water nuisances liable to breed mosquitoes whenever such nuisances are detected on premises concerning which they are responsible.
>
> (7) Pools, pits, ponds, barrels, etc., untreated marshes in populous places, containing water not used for domestic purposes, are petrolized.
>
> (8) Very many of the streams, drains, canals, pools, ponds, large water recipients, etc., etc., have been stocked with " millions " or gold fish or both. (In this connection it may be interesting to note that, according to some observers, the most efficient larvivorous fish in Mauritius is a species of perch, *Ambassis commersonii* locally known as " Marie-Jeanne.")
>
> (9) Numerous defective pipes and " regards " have been repaired.
>
> (10) On a certain number of premises and in front or by the side of many public fountains " rough filter absorption pits," have been constructed and the surplus and used waters made to discharge into them, thus avoiding the creation of mosquito-breeding pools in yards and road-side gutters.
>
> (11) Formerly the Quatre Bornes Board employed three men and a cart to collect old tins, conch shells, broken bottles, etc., etc., from yards, but this, I believe, was discontinued for a long time and has only lately been renewed.
>
> (12) On Alma Estate the Manager encouraged the removal of old tins, broken bottles and conch shells by giving one cent for each of those articles that was brought to the accountant of the Estate.
>
> (13) As far as possible, all rank and noisome vegetation and undergrowth have been ordered to be removed over a distance of at least 200 feet from inhabited dwellings and, for some time past, this distance has been extended to 600 feet."

Other anti-malarial measures in force are :—

(1) The use of mosquito nets by those who can afford them. I found the nets were often of an unsuitable type and were wrongly hung; faults commonly encountered in the tropics.

(2) The removal of sugar estate camps and labour camps from low-lying unhealthy areas to higher and drier ground. This has proved its value in several instances.

Since the great malaria epidemic many of the inhabitants have quitted the coast regions and other unhealthy localities for the high plateaux. This process of migration still continues, and few persons of means and consequence now live in Port Louis, though a moiety return to it for a few months in the winter.

Everywhere one finds that houses have been pulled down in the malarial regions and transported for re-erection to Quatre Bornes, Phœnix, Vacoas and Curepipe.

Propaganda work.

(3) Propaganda work has been instituted in some measure. The course of lectures delivered to schoolmasters by the Sanitary Warden, Port Louis, includes instruction on malaria and mosquitoes, and in the schools an effort is made to interest the children in such matters, but, as will be seen, it is to a large extent ineffective. Illustrated posters have been employed to some extent, but there is great need for a more intensive campaign in this direction.

Legislation.

(4) Legislation exists but is defective.

In my Report on the Sanitation of Port Louis I wrote as follows :—

" The only enactments under which action can be taken are the Public Health Ordinance, No. 32 of 1894-95, article 29, dealing with nuisances, and the Public Health Amendment Ordinance, No. 31 of 1913, article 4, which states that a nuisance includes :

' All collections or accumulations of stagnant water liable to breed mosquitoes, all bottles, whole or broken, all tins and boxes empty and open, conch shells, broken crockery, jars and all other articles which form receptacles used for water liable to breed mosquitoes, all receptacles used for storing water which receptacles may have been condemned as unnecessary by the Sanitary Authority.'

" This is not sufficient from a sanitary standpoint, though doubtless of some service.

New regulation suggested.

" It is, however, much more important to have a regulation setting forth that anyone upon whose premises certain of the water stages of mosquitoes are found is liable to a penalty. This means that if larvæ or pupæ of any species of mosquito are discovered in any kind of water receptacle or collection on any premises, the owner or occupier as the case may be, will be fined unless he can establish his innocence. The penalty must not be too trifling and must be rigidly enforced. In no other way with which I am acquainted can the mosquito nuisance be properly dealt with in towns. If a Government Department or the Municipality is breeding mosquitoes, the Department or Municipality is fined; if a private individual is at fault he is punished, whether he be a wealthy owner of property or the poorest of peons. A discriminating magistrate will modify the fine to suit the financial status of the offending party, but there should be a minimum penalty. All must be treated alike, without fear or favour, and this will be possible when there is efficient and reliable control and inspection."

Beneficial results.

It is evident that a great deal has undoubtedly been accomplished (Figs. 25, 31, 34-38), and from what I have seen and heard it seems certain that very considerable benefit has accrued. A good example is furnished by

Chart 1, which shows what occurred on the Labourdonnais Sugar Estate, both before and after 1908, the year when Ross visited the Island. The record has unfortunately not been kept since 1911, but malaria, though still present, is no longer the serious disease it was. I owe the Chart and information to the kindness of the Manager, Mr. A. Wiéhé. There are areas where both anophelines and malaria have ceased to exist, and where there is now no opportunity for the former to re-establish themselves. One of the best examples is at Rivière Seche in Flacq (Fig. 33), where the anti-mosquito work instituted by the last Governor, Sir John Chancellor, K.C.M.G., has been specially successful. The yearly number of deaths reported as due to malaria at the time Ross visited the Island was roughly 5,500. For the decade ending 1919 the average was 4,082; the actual number in 1920 was 3,537.

As already explained, these are *fever* deaths and a certain proportion of of them is due to other causes, but indication is certainly given that there has been a reduction in the malaria mortality, which, with reason, may be attributed to the work that has been accomplished.

I would pay a tribute to the zeal and energy of Dr. Castel. He has not spared himself in his efforts to ameliorate local conditions, and when necessary he has not hesitated to carry out his duties in the face of obstruction and opposition.

Dr. Castel's work.

The work has been difficult in several directions, and it is to my mind remarkable how Dr. Castel has succeeded in getting the best out of his labour gangs. (Fig. 28.) While this is true I am not prepared to say that the anti-malarial measures have always been conducted to the best advantage. There has, I fear, been what may perhaps best be termed a dissipation of energy and a lack of that regular and systematic work which is so important. No doubt this is in part due to the fact that expediency has of necessity played a part in determining what work had to be accomplished, but I cannot help feeling that it would have been a wise policy to concentrate to a greater extent on special localities. I admit, however, that my knowledge of the local conditions, and of what has obtained in the past, is of necessity limited, and I feel it would be unfair and ungracious to criticise unduly work which has certainly been done whole-heartedly and which has undoubtedly proved effective in many instances. In certain places local authorities have done well, notably perhaps at Rose Belle and Mahebourg, where in all sanitary matters the District Board of Grand Port, owing partly to the influence of Mr. Gaston Gébert, has been specially active and has co-operated to good effect with the sanitary authorities. There has, however, generally speaking, been a tendency after carrying out necessary improvements to neglect upkeep, a fault noted long ago by Fowler, while both in Port Louis and elsewhere there have been many shortcomings, and the dual control to which reference has been made has undoubtedly exercised in many instances a malign influence.

In this connection I would refer to certain remarks in my reports on Port Louis and on the Beau Bassin-Curepipe area.

Factors militating against progress.

It is unnecessary to enter here into all the causes which have been operative in hindering progress and stultifying efforts; the internecine warfare, the procrastinations, the undue consideration for vested interests, the lack of co-operation on the part of some of the sugar estates, the shortage of funds, the scarcity of labour. These have been dealt with elsewhere.

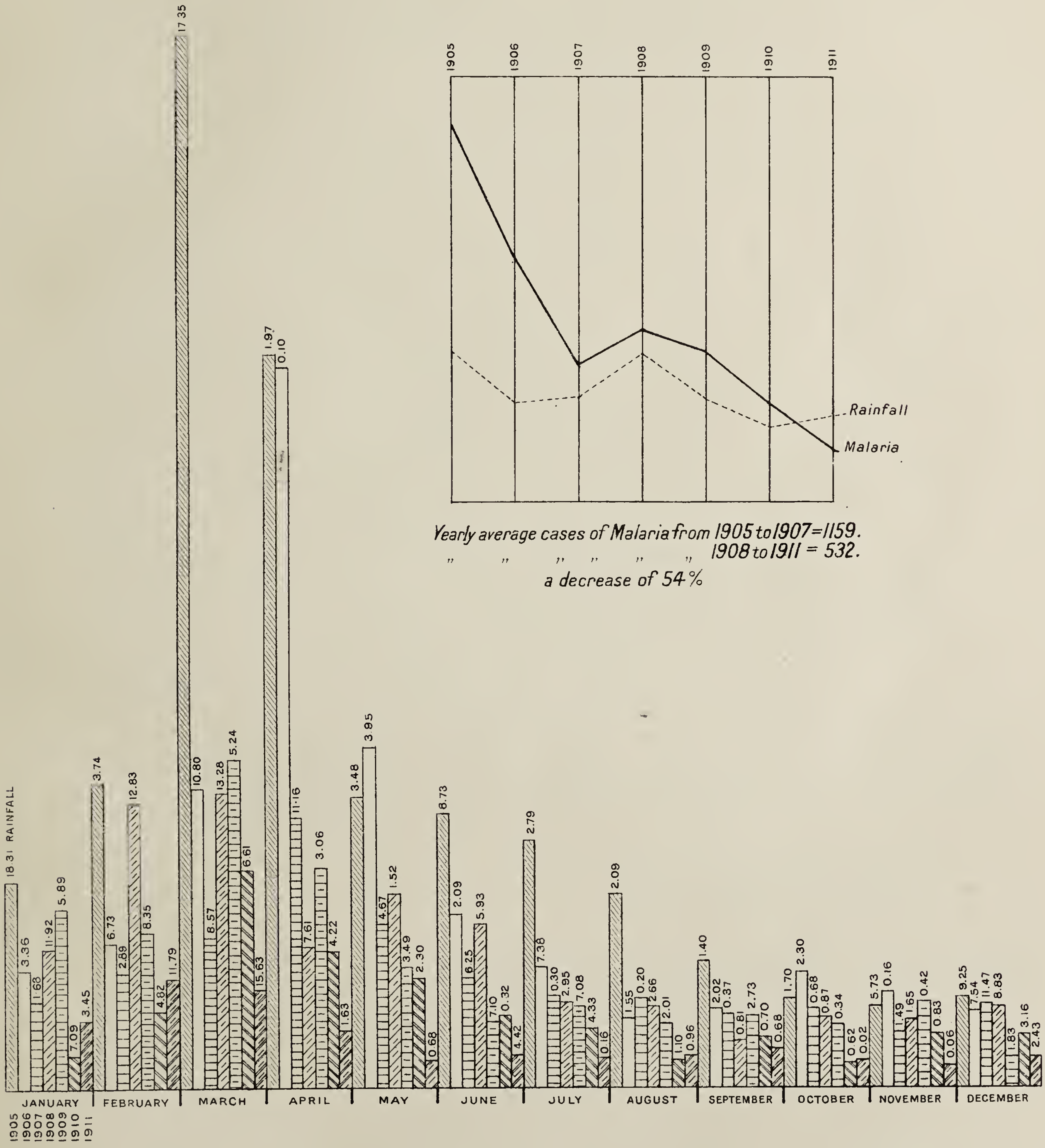
Causes of comparative failure.

Speaking generally it may be said that the ideal set by Ross has not been approached, partly because full effect has not been given to his recommendations, partly because, having probably no choice in the matter, he left the campaign to be carried out solely by those on the spot, partly for the reasons above indicated, and partly because, sound as the recommendations were, they did not fully meet the exigencies of the situation.

CHART I.

ETABLISSEMENT LABOURDONNAIS (WIEHE-SOUCHON)
RAINFALL & MALARIA 1905-1911.

The destruction of Mosquitoes according to Sir RONALD ROSS' recommendations was adopted in 1908.
Scale of One Millimeter to One case of Malaria.



Yearly average cases of Malaria from 1905 to 1907 = 1159.
" " " " " " 1908 to 1911 = 532.
a decrease of 54 %

Chart showing relation of Malaria to Rainfall & also the results of anti-mosquito measures at Labourdonnais Sugar Estates, Rivière du Rempart, from 1905 to 1911.

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In proof of some of these assertions I would again point out that no full-time malaria authority was appointed, that the local health administration was inefficient, that there was a lack of experience and of up-to-date scientific knowledge, and that the old adage, " A prophet is not without honour save in his own country," was accorded undue respect.

Moreover, it must not be forgotten that, as James says in his excellent book, " Malaria at Home and Abroad," " *until a high percentage of the total potential breeding places in the area have been eliminated no appreciable reduction of mosquitoes results.*" Considering Mauritius as a whole it cannot be said that this desideratum has yet been reached.

The winter conditions.

The statement that the recommendations made did not fully meet the exigencies of the situation is based upon certain observations made during my visit. Ross saw the Island during the summer months when malaria was rife. I saw it for the most part during the winter season when, apart from relapse cases, there was not a great deal of malaria. Accordingly I had an opportunity which was not afforded him, of studying the conditions of mosquito life during the cold weather. Without entering into details I may say that I was greatly struck by the way in which, during the winter, the breeding area of *Anopheles costalis* became restricted. In many places which looked entirely suitable for their broods (Figs. 5 and 6), and in which I was told that, during the summer, larvæ were plentiful, I could find none after careful search. Indeed, save for some low-lying valleys in Flacq, parts of Moka at no great height above sea level and a neglected area at Quatre Bornes, the nurseries of *A. costalis* seemed to be confined to the littoral. I say " seemed " advisedly, for I had no time to make very extensive investigations. My observations, however, agreed with those recorded by Dr. Castel and his assistants, and there can be no doubt that in the cold season the number of *A. costalis* nurseries is very greatly reduced. Indeed, even in the coastal region the larvæ are not very abundant. They are much less numerous than those of *A. mauritianus* and again and again long and likely stretches of streams or pools and puddles well suited to their requirements were found untenanted. This is a matter of great interest and importance. It is difficult to discover adult *A. costalis* during the cold weather, and it would seem that in all probability one of three things occurs :—

Restriction in the breeding area of *A. costalis*

Three possibilities as regards *A. costalis* during the winter season.

(*a*) The adult females hibernate during the period or at least remain concealed somewhere in a more or less dormant condition.

(*b*) They confine their breeding operations to the limited localities mentioned and spread rapidly from these foci as soon as the warmer weather begins.

(*c*) They over-winter as ova or larvæ in these situations.

It is not at present feasible to say which of these possibilities constitutes the correct explanation.

The question of hibernation.

More than one may be concerned. I searched underground premises at the Observatory, Pamplemousses, and examined a few cowsheds, but could find no trace of hibernating females. It is, however, conceivable that hibernation, or a process analagous to it, may take place in the open, in the vicinity of marshes or amongst woods and undergrowth. *A. costalis* unlike *A. maculipennis* does not appear to seek the shelter of stables and cowsheds. The weather is never very cold in Mauritius, and there would be no need for *A. costalis* to obtain warmth from proximity to animals.

On the whole I think it unlikely that hibernation occurs. Dr. Castel, however, has agreed to instruct two of his best " moustiquiers " to carry out a careful search, and it is hoped this may throw light on the problem.

From the *immediate* preventive standpoint it does not very much matter which of the three hypotheses is correct, though it is true that the occurrence

Necessity of dealing with mosquito reservoirs.

of hibernation wiuld make the anti-mosquito campaign more difficult and costly and might defeat the attainment of any permanent result. It is, however, clear that the best time to destroy the broods is during the cold season, when the nurseries are few and scattered. This cardinal fact has not been recognised. Much time and money have been spent on the various operations which have already been recorded, but it seems to me that what is urgently required is an active and intensive campaign against what we may call mosquito reservoirs. In the Black River District especially I found that no attention was being paid to certain places where *costalis* larvæ were present in abundance. In due course these would pupate, the pupæ would hatch out and there would be a supply of female anophelines ready to spread infection.

In my report on Rivière du Rempart and Flacq (No. 5 of the series) I refer to the matter on p. 5. I speak of the question as a crucial one and state that if there is difficulty in solving it I believe it would pay to enlist the services of an expert entomologist. The recommendation is also made that during the cold season the mosquito brigades (*vide infra*) should be withdrawn from localities in which there is little or nothing for them to do and concentrated in the places where *A. costalis* is breeding.

An increased acquaintance with local conditions and an opportunity of reviewing the whole situation has led me to the belief that something on a larger scale is required.

The situation reviewed.

From the point of view of the malariologist the position is peculiar and possibly unique, as the following considerations will show :—

(1) Mauritius is a comparatively small island, well furnished with roads and railways. (*Vide* Map III.) The introduction of motor bicycles and motor cars has brought about a great change in the transport problem and has enormously simplified health work.

(2) To all intents and purposes there is only one species of malaria-carrying mosquito.

(3) The range of this mosquito is greatly restricted during the winter months, *i.e.*, May to October.

(4) The conditions are such that a properly planned and concerted attack on the anopheline nurseries during the winter months would certainly bring about a great diminution in the number of *A. costalis* with a consequent marked decrease in cases of malaria, and, if not actually leading to a total extinction of the mosquito, might at least so reduce its numbers as to render it negligible and capable of being kept so in the future.

Suggested expedition.

To achieve such a result it would be necessary to despatch a band of well trained and energetic young and keen entomologists under an experienced malariologist, who would direct their operations.

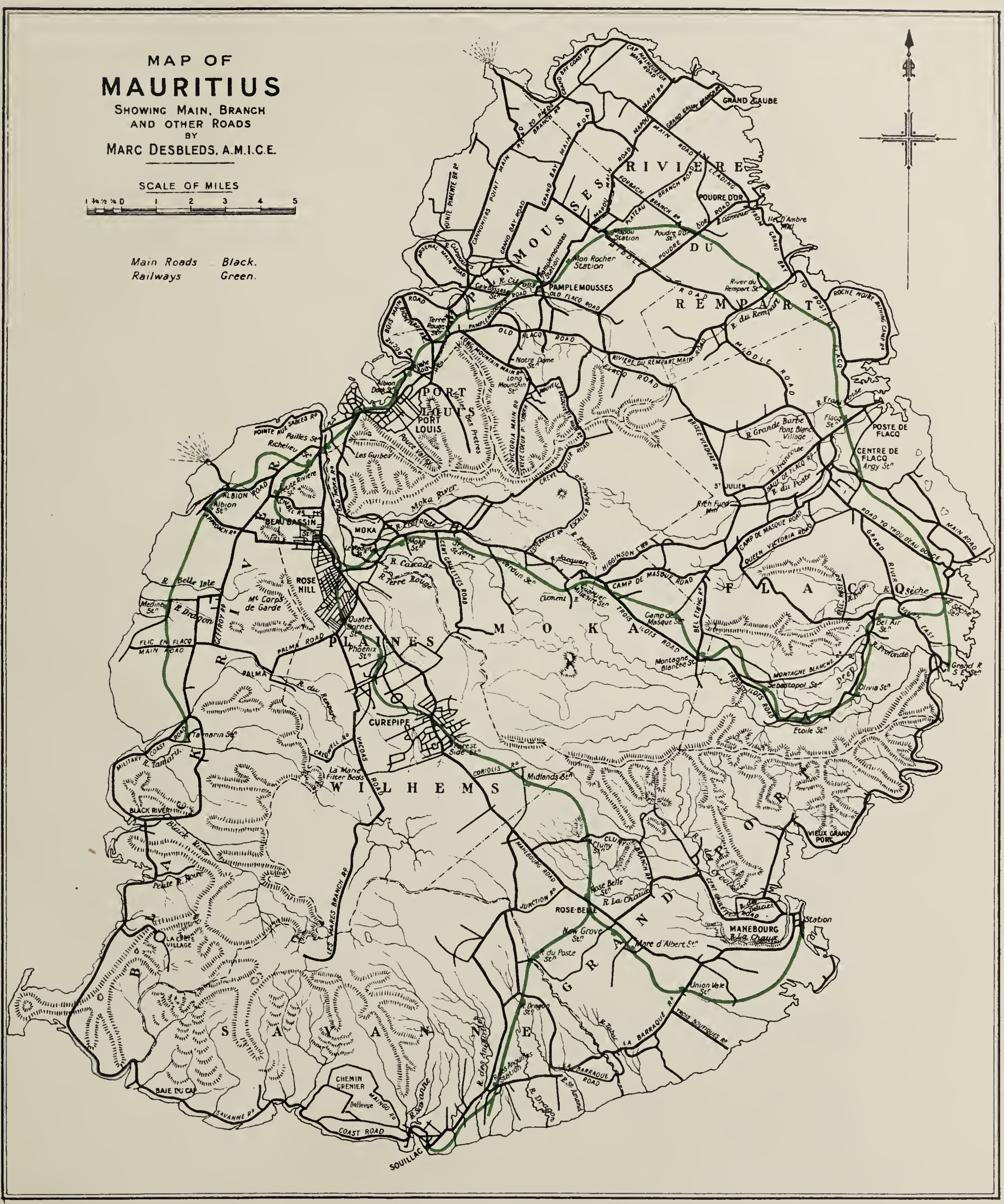
At least six entomologists would be required and with them there should be six men of the qualified Sanitary Inspector class familiar with anti-mosquito work, accustomed to handle coloured subordinates and to superintend the operations of mosquito brigades.

Such a mission would link up with the Malaria Authority, or, as I prefer to call him, the Special Malaria Officer in Mauritius, and would have at its disposal as many of his trained personnel as could be spared.

Lines of proposed work.

There would have to be a thorough and systematic search for all breeding places and the larvæ would be destroyed whenever found. In many cases this would be a simple matter and merely mean cleansing streams and pools of weed, for larvivorous fish abound but are prevented from destroying the mosquito broods owing to the presence of the weed. I saw an excellent

MAP III.



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MAP OF MAURITIUS *showing roads & railways.*

example of this state of things in the River des Galets, Black River District and in certain irrigation pools on the Coriolis estate at Quatre Bornes. The recent work of Barber and Hayne, in the U.S.A., indicates that powdered Paris Green might be usefully employed as a larvicide in many situations. The question merits very careful consideration and experimental trials.

The majority of the actual and potential nurseries are well-known and many are already charted. Most of them are nowadays easy of access and in the winter the conditions of work are agreeable. It must not, however, be imagined that the campaign will be either simple or easy. It will mean hard and unremitting, if straightforward, work, and in some districts heavy rainfall may prove a disturbing factor. The attempt will not be successful unless it is thorough, but if it is thorough then the game would appear to be worth the candle owing to the unique conditions obtaining.

If the adult female mosquitoes are found to hibernate, it might be feasible to destroy them *in situ* possibly along the lines employed with success by Sella in Italy in the case of *A. maculipennis*. The existence of hibernation would, I fear, complicate the problem, but I very much doubt if it occurs. At the same time Dr. Marshall informs me that there is some evidence of *A. costalis* hibernating in Africa. It is not, however, very convincing.

It is not intended that this work should, at present, supplant the ordinary anti-malarial operations, *i.e.*, training and canalisation of streams, drainage, deepening of swamps, etc. It would supplement these, but might eventually render them unnecessary.

Preliminary enquiry.

It may be thought that before such work was undertaken more preliminary enquiries should be made. It is true these would be advantageous, but on the other hand there can be no doubt that a properly conducted campaign of the type indicated would *in any case* be highly beneficial. What the Mauritians very naturally desire to see is something tangible resulting from the visits of experts and the spending of large sums of money. Apart from this aspect of the question, if the Mission accomplishes what may reasonably be expected of it, there should be a considerable saving in total expenditure, for it should then be possible to curtail some of the major works(¹).

General recommendations.

Other recommendations made in the interim reports deal with the establishment of a Malaria Diagnosis Centre in Port Louis, the use of trap pools (Fig. 19) for the purpose of gaining information as to the prevalence and movements of anophelines, the employment of petroleum fire sprays like those used by the Americans in Panama, the introduction of cresol as a larvicide, the necessity for extensive clearing operations in the vicinity of Port Louis, the utilisation of animals, more especially cattle, as providers of blood feeds for anophelines, the deepening of certain swamps, the introduction of sluices into dams for the purpose of scouring depleted sections of rivers and streams (Fig. 12), the possible value in certain localities of the "vertical drainage" successfully employed in Alabama, U.S.A., the cultivation of sunflower in certain places(²) and the revision of the existing law.

It is unnecessary to enter again into most of these questions, but they are all worthy of consideration and some of them represent new developments since the days when Ross made his survey.

He suggested the introduction of *Anopheles* (*Myzomyia*) *rossii*, a non-malaria-carrying mosquito, as a possible means of crowding out *A. costalis* The experiment would have been an interesting one but it has not been attempted.

(¹) It was finally decided to despatch an expert field entomologist to carry out a preliminary investigation and accordingly Mr. M. E. MacGregor left for Mauritius in April, 1922. He is expected to be nine months or a year in the Colony.

(²) Useful information regarding sunflower cultivation is obtainable from Bulletin No. 1,045 of the United States Department of Agriculture, which deals with the sunflower as a silage crop, and is written by H. N. Vinall. It can be procured from the Department of Agriculture of the United States.

The possible value of *C. tigripes.*

Long ago Mr. D'Emmerez de Charmoy pointed out the cannibalistic habits of the larvæ of *Culex tigripes*, a fairly common Mauritian culicine, and recorded observations of their effects on anopheline larvæ in the laboratory.

Before I heard of this work I had found in trap pool experiments near Port Louis that the larvæ of *Culex tigripes* were very deadly to those of *A. costalis.* Reference to the matter will be found on p. 8 of my second interim report. An effort was made to conduct two experiments in the field, but unfortunately, owing to unexpected and unintentional interference, the observations could not be completed. I think the matter should be further investigated, for the results of the trap pool investigations are suggestive. It is, however, only under certain conditions that *C. tigripes* can prove effective. It may be noted that this mosquito rarely, if ever, attacks man.

The problem of irrigation.

Although some mention of it was made in interim reports Nos. 6 and 7, *i.e.*, those dealing respectively with the districts of Black River and Pamplemousses, the problem of irrigation in Mauritius in its relation to malaria is one which must receive attention here.

The late Governor, Sir John Chancellor, K.C.M.G., displayed much energy in framing and carrying into effect extensive schemes for irrigation. There can be no doubt that from an economic standpoint the large reservoirs at La Ferme and Nicolier, the former complete, the latter in course of construction, will lead to considerable agricultural development and be the means of placing under cultivation large areas of land which at present are barren and unproductive.

Moreover, in some measure the formation of these extensive sheets of water should prove beneficial from the standpoint of the malariologist.

La Ferme.

Where the waters of La Ferme now form a lake full of fish there was formerly a swamp, the breeding place of *Anopheles costalis.* This has been abolished, although, when the reservoir is low, there is a dangerous approximation to the previous condition (Fig. 7), so much so, that the place will require careful watching. Indeed I suggested that it should have a " moustiquier " to itself during the time that the basin is shallow and reedy.

Nicolier.

The formation of the Nicolier reservoir will blot out of existence a large number of anopheline nurseries, both actual and potential, for the valley which its waters will fill is distinctly malarious. On the other hand, one cannot view the development of these large irrigation schemes without considerable anxiety. We know that irrigation can be so controlled as to reduce the risk of malaria resulting from it to a minimum, but this is never an easy proposition, and in Mauritius it is likely to be a very difficult one.

Experimental irrigation centre.

Hence one hails with satisfaction the establishment of the Government Experimental Irrigation Centre in the Black River District, for the work there should furnish data urgently required for the proper control of irrigation. At present both in Pamplemousses and Black River, but especially in the latter district, the conditions are very bad. (Fig. 10.) Water is wasted, pools and puddles form, and in many places the conditions are ideal for the broods of *A. costalis.* Moreover, the irrigation channels are badly constructed and ill-kept. Leakages are common and the conduits become overgrown with vegetation. I think that at the present time an Irrigation Board is required and that rules should be framed and strictly enforced. It seems to me that a good deal could be done in the way of checking waste of water by fixing sluices at all spots where waters of streams and rivers are tapped for irrigation purposes and insisting that only sufficient water to serve the crops be taken. Some data on this subject already exist and would form a rough guide until the Irrigation Centre is in possession of the necessary information.

Establishment of Irrigation Board.

There should be no delay, for the situation is serious. Prior to the waters of the Nicolier reservoir being used for irrigation a consultation should be held by the Directors of the Public Works, Agricultural and Medical and Health Departments, the irrigation system should be approved as a whole by the Sanitary Department and rules should be drawn up to ensure that the irrigation measures are carried out on sound lines and that penalties can be imposed on those who by their carelessness or wilful disregard endanger the public health.

Danger of delay.

PLAGUE.

This disease, so far as can be told, had been absent from Mauritius since 1915, and rats in Port Louis were reported free from infection during 1919-1920. The campaign against rats was, however, continued, and shortly after my arrival, *i.e.*, on April 15th, a rat was found harbouring *B. pestis.* The examination of rats for plague was found to be inadequate and a memorandum was submitted on the subject indicating how it should be improved. The faulty method was due largely to paucity of staff.

Plague.

It may be mentioned that all rats killed in traps should be conveyed to the place of examination in a covered receptacle—a small pail serves the purpose—as there is a danger of dead rats shedding fleas during transport.

Trapping and examination of rats.

During my visit plague recrudesced. Some believe that the disease had been running as an epizootic in rats through the interval of apparent freedom but that, the virus being of low virulence, it had not attracted notice.

Recrudescence of plague.

Others are of opinion that plague rats or fleas were introduced, possibly from Madagascar, where the disease was epidemic. The truth of the matter will never now be known, but it is interesting to note—

> (1) That Lafont, the former distinguished Director of the Bacteriological Laboratory, was of opinion that plague could not be stamped out of Mauritius without very heavy expenditure, owing to the vast numbers of rats, the exceedingly favourable conditions for their existence and propagation, more especially in Port Louis, and the inaccessibility of their habitats.
>
> (2) That the absence of deep water wharves in Port Louis Harbour affords a certain measure of protection.

Views of Lafont.

At the same time there are quays to which coasting vessels and even small ships trading with Madagascar tie up and at first none of the usual preventive measures were in vogue either as regards these vessels or those in dry dock.. Doubtless also rats and fleas gain the shore in the lighters and in cargo, more especially grain.

Danger from sailing vessels.

So far as rice is concerned it is interesting to note that Flu, as the result of observations at Palembang, considers infected fleas more important than infected rats. They are easily transported in rice and can survive for 10-14 days without food.

I note that de Goyon in the *Bulletin de la Société de Pathologie Exotique* for November 9th, 1921, states that plague is endemic in Mauritius, and suggests that Madagascar may have been infected by plague rats from the Island.

It should, however, be noted that human plague broke out in Madagascar in February several months before the first case occurred in Mauritius.

Possibility of infection from Madagascar.

Still it must be remembered that plague may run as a chronic disease in rats causing the rodents little, if any, inconvenience and it is possible that it persisted in this form in rats in Port Louis between the periods of apparent disappearance and recrudescence.

Outbreak of plague.

The first case of human plague, which was of the bubonic type and fatal, occurred on May 25th, and is mentioned in my second interim Report. There were no more cases until an outbreak occurred on June 27th in the camp of the employees of the Mauritius Dock Company. It had no direct connection with the first case and was stamped out by complete evacuation of the infected area in addition to other measures, including prophylactic inoculation on a large scale. This small and localised epidemic of 12 cases with 9 deaths ended, as mentioned in my second interim Report, on July 14th, and, though the epizootic continued to run its course in rats, nothing more was heard of human plague until August 24th, when cases began to crop up in different parts of Port Louis. These were scattered and it was difficult to deal with them, but all ordinary measures including Claytonisation (Fig. 48) were again put in force, and with a view to protecting other ports, such as Souillac, from rat invasion, attention was directed to the necessity of safeguarding island schooners and other small craft tying up to the wharves in the harbour (see p. 9 Second Interim Report). (Figs. 45, 46 and 47.)

Extension of the disease.

The disease continued to spread and was on the upgrade till the end of October, after which a decline set in. At the time of writing, December 17th, the Colonial Office has had reports of 321 cases with 222 deaths(¹). The disease has extended from Port Louis into the districts of Pamplemousses and Rivière du Rempart. As early as April 5th the Colonial Secretary asked me if, in view of the fact that plague had been reported from Madagascar, it would be advisable to obtain fresh stocks of prophylactic vaccine and curative serum, those in Mauritius being old and nearly exhausted. I replied in the affirmative, though I pointed out that the value of Yersin's serum had not been fully established, and that it was known to be slight unless the serum was given early and in large doses. Supplies were, however, ordered both from India and South Africa.

Precautionary measures taken.

India was unable to send either vaccine or serum, but a large supply of vaccine was received from Johannesburg and used to inoculate the ratcatchers and the contacts in the outbreak at the Dock Company's camp. A further supply was obtained later and freely used. Serum was not forthcoming.

The cases were for the most part of the bubonic type, but a few pneumonic cases occurred. There were also some pure bubonic cases in the sputum of which *B. pestis* was found.

Plague carriers.

In this connection it is very important to note that Rees and Targett, working at plague in the Free State, South Africa, cited instances where virulent *B. pestis* persisted in the sputum of pure bubonic cases for as long as two months after recovery. Presumably such cases are infective, and it is necessary that they should be kept under bacteriological investigation.

Difficulty in fighting plague.

In fighting plague in Mauritius the same difficulties are encountered as are met with elsewhere in the tropics, *i.e.*, concealment of cases, difficulties in diagnosis and in getting cases removed to hospital, lack of faith in the protective powers of plague vaccine, want of co-operation in the anti-rat campaign and so forth.

Wholsale grain stores.

Lafont, quoted by Anderson, has some very sound remarks in this connection. He draws attention to one very important matter, to which I also had to allude, namely, the presence of wholesale grain stores in Port Louis. I had a list of these prepared. There are 40 of them within the

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(¹) The epidemic ended in February, 1922, there having been in all 390 cases with 267 deaths.

municipal area, and so long as they persist in their present condition, and so long as insanitary Chinese shops and restaurants are present it will be exceedingly difficult to deal with the town rats.

Rat-proof godowns.

The suggestion was made that large rat-proof godowns under Government control should be erected within the harbour boundaries, and that all grain landed should be stored in these and only retail shops permitted in the town. Unfortunately there is not sufficient space available to carry out such a scheme, and the problem still awaits solution. It is intimately bound up with the expropriation and building improvement proposal put forward with reference to a certain section of Port Louis adjoining the docks. (See Interim Report No. 1.) The presence of many old underground drains in Port Louis, which afford safe harbourage for rats, makes the whole problem of anti-plague work there exceptionally difficult. When the new sewerage scheme is carried into effect, the opportunity should be taken of abolishing as far as possible these subterranean rat nurseries and playgrounds.

Danger of old drains.

Plague in the districts.

So far as the country districts are concerned Lafont's recommendations still hold good to a large extent. They comprise "the determined chasse aux rats" on every estate, the firing of every old camp, the abolition of cellars from every mill and house, the concreting of floors and constant disinfection with 5 per cent. lysol, as well as the introduction of more cats and rat-terriers as well as of owls and mongooses. Moreover, every gunny bag in the Island must be thoroughly disinfected, as they harbour a great many fleas.

It may be said that the mongoose has become so numerous and such a nuisance that it would be both unwise and unnecessary to introduce more of these destructive creatures, that action must be taken as regards the loose stone walls so common in Indian locations and which afford such safe harbourage for rats, and that the introduction of Lelean Sack Steam Disinfectors will simplify very greatly the problem of disinfecting gunny bags and grain sacks. (Fig. 43.)

Sources of useful information for future work against plague.

Attention was directed to the desirability of obtaining copies of the U.S.A. Public Health Report for November 5th, 1920, which furnishes useful information regarding rat surveys and rat-proofing and contains the provisions of a Model Ordinance designed to regulate building with reference to rat-proofing. In the Tropical Diseases Bulletin for May 15th, 1920, will be found an excellent illustrated account of the type designs of the Madras Sanitary Board for Rat-Proof Grain Godowns, and there are more recent communications, including a specially useful paper by Uriarte, of Buenos Aires, which figures improvised and cheap forms of rat-proof stores. These would appear to be suitable for conditions at Port Louis. The paper was published in the *Annales del Departmento Nacional Higiene*, Vol. XXVI., No. 5, 1920, but a French translation with illustrations will be found in the Monthly Bulletin of the Office International d'Hygiène Publique, Vol. XIII., No. 7, of July, 1921 (1).

From the point of view of sugar estate camps, the most useful information, as regards rat-proofing, will be found in the recently published Dutch paper, "Rubbercultur in Nederlandsch-Indië Bedrijfshygiene," by E. P. Snijders.

Danger of sleeping on or near ground.

It is worth noting that in all probability there is a distinct connection between the incidence of plague and the habit of sleeping on or near the ground. Attention has been directed to this matter in Colombo, and there can be little doubt that in Port Louis and elsewhere there is a considerable liability to contract plague owing to the sleeping arrangements of the poorer inhabitants.

The suggestion was made that the method of treatment by intravenous injections of iodine should be tried, but little or nothing had been done in this direction prior to my departure.

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(1) A review of the paper, also illustrated, has now appeared in *Sanitation Supplement* No. 2 of the *Tropical Diseases Bulletin* for June 30th, 1922.

The question of hospital accommodation for plague cases will be considered in the succeeding section of this report.

PNEUMONIA.

Pneumonia.

Pneumonia in Mauritius, as elsewhere, is one of the "Captains of the men of death." It seemed during the time of my visit to be chiefly a concomitant of influenza, and its spread was undoubtedly favoured by bad housing conditions, the habit of closing up the windows of sick rooms, especially at night, and by inefficient clothing. The poorer classes of Indian especially wear the same thin and flimsy garments during the cooler period of the year as they do during the hot season. Moreover, no change of clothing is provided for those working in sugar factories and warehouses and passing from a heated atmosphere to the comparatively chilly night air.

The question of clothing.

It would pay employers to consider this question carefully and, during the winter at least, to supply warm jerseys to their men when the latter cease work in the evening. I am glad to say that one of the Managers of the Mauritius Dock Company signified his readiness to give the recommendation a trial.

There can be little doubt that alcoholism greatly favours the occurrence of pneumonia in the Colony. Unfortunately, of late years many of the Indians have taken to drink and, becoming even more careless of their health than usual, suffer accordingly.

PUERPERAL FEVER.

Puerperal fever.

In the Registrar-General's Report for 1919 the total number of deaths from this disease was given as 21. In 1920 it was 16. These are surprisingly low figures considering the conditions under which child-birth frequently occurs, and a similar paucity of cases is apparent in the returns from the Civil Hospital, Port Louis, for the last three years. It is, however, of interest to note that in Trinidad the figures are very similar, those for 1917, 1918 and 1919 being 20, 20 and 34 respectively.

Statistics.

It is possible that the disease is more common than is generally supposed, though in all probability its incidence has diminished of late years owing to measures which have been rendered possible by the de Chazal bequest (*vide infra*).

There may be a certain racial immunity, while the ease with which parturition is usually accomplished in the coloured races may militate against the production of points of entry for the causative organisms.

RABIES.

Rabies.

Rabies is now unknown in Mauritius, but this was not always the case. Strange to say there is a very prevalent belief that the disease in dogs was stamped out of existence by the great cyclone of 1892.

It is, of course, possible that all the mad dogs happened to be destroyed at that time, but it is not a very likely story. Still the fact remains that rabies has disappeared and that so far the regulations in force have succeeded in preventing its reintroduction. They appear to me, however, to leave a loophole to which I felt it advisable to direct attention, as it would be a very serious matter if hydrophobia gained a footing in the Colony.

Defective regulations

Stray dogs, many of them diseased, are quite a feature of the Island. They were very prevalent in Port Louis, but latterly the police have taken more vigorous action, and a small lethal chamber was erected, which makes the work of destruction more merciful, at least so far as Port Louis is concerned.

SCHISTOSOMIASIS.

It has long been known that urinary bilharziasis exists in Mauritius, and Dr. Momplé and Mr. Maya have carried out investigations with a view to incriminating the snail host or hosts of the parasite. In this they have so far been unsuccessful, though several species of cercariæ belonging to schistosomes other than *S. haematobium* have been found.

Schistosomiasis. Urinary.

The Grand River N.W. and its tributaries were known to be infected, and I collected records of 41 cases treated during the last three years in the Civil Hospital, Port Louis, but the true incidence of the disease in Mauritius has yet to be determined. I found that it was present at Bambous in the Black River District, and there is evidence of its presence in other parts of the Island. As already stated, I was informed by a dispenser in one of the sugar estate hospitals, a man with considerable experience of clinical microscopy, that he had once seen the lateral spined eggs of *S. mansoni* in excreta, but this is the only record I could find of the occurrence of the intestinal form of the disease. It seems either to be rare or altogether absent. The matter should be investigated, as should the whole question of schistosomiasis.

In Port Louis.

Does the intestinal form occur?

Save in the case of private practice its treatment so far has been merely symptomatic, for the Government hospitals and dispensaries were not provided with pure tartar emetic, while emetine injections had not been tried. This must be remedied, not only for the sake of the sufferers but for purposes of prevention.

Treatment of:—

As indicated in interim report No. 2, more use should be made of ducks, which destroy the snail hosts and have been found valuable by Cawston in Natal. The use of copper sulphate for the same purpose, as recommended by Chandler, also merits attention.

Preventive measures.

SKIN DISEASES.

Of these scabies is one of the most important. It is common and entails much suffering. It is not confined to the lower orders of the community. Better class people not infrequently contract it, and it assumes forms which may not be easy to diagnose. It is believed to be spread by the dhobies, but further evidence on this point is required. Other parasitic infections, such as favus, impetigo and ringworm occur, and the faulty sanitary conditions in schools, certain orphanages and hairdressers' shops doubtless favour the spread of these disorders.

Skin diseases. Scabies.

Fungus diseases.

It is very necessary that attention should be directed to the etiology of the ulcerative conditions which are so common. *Ulcus tropicum* is known to exist, and Dr. Rouget in 1903 described it as occuring in epidemic form. I have been told that ulcerating granuloma of the pudenda has been reported. The chigger flea has been introduced but does not spread. Probably the soil conditions are unfavourable.

Ulcers.

SMALL-POX.

Small-pox is not much in evidence, vaccination being the rule and the calf lymph employed being effective. Difficulties of transport of lymph, so often encountered in the tropics, are non-existent in Mauritius.

Small-pox.

It is important to note, as pointed out to me by Mr. Walter, that a considerable number of Mahommedans every year evade the law relating to vaccination, and that, as a result, the number of unvaccinated persons in Mauritius is increasing. I have asked that the matter be thoroughly investigated before it is too late and an outbreak of small-pox shows the folly of those who endanger their own lives and those of others.

Evasion of vaccination.

TUBERCULOSIS.

Tuberculosis.

Tuberculosis in its pulmonary form ranks next to malaria as a destroyer of human life in Mauritius. The factors favouring its occurrence and spread are the same as those elsewhere, i.e., faulty housing conditions, poor food, unsuitable clothing, poverty and alcoholism. There can be little doubt that ankylostomiasis is an important predisposing cause.

Tuberculosis Dispensary.

So far as Port Louis is concerned, the question has been fully discussed in my second interim report, where the establishment of a tuberculosis dispensary was advocated, and there is no need to recapitulate, but the problem of combating this white plague elsewhere in the Island is by no means easy, for it entails a campaign against faulty social conditions which must be accompanied by educational propaganda. Something has been done in the way of directing attention to the danger of promiscuous expectoration, but much more is required, and without ample funds, not only to inculcate the lessons of hygiene but to enable them to be carried into practice, little can be done. Hence I have suggested that help might possibly be obtained from the International Health Board, which not long ago established a Commission for the Prevention of Tuberculosis in France and carried out work by means of the following Departments :—

Aid from International Health Board.

(*a*) Medical, which operates model dispensaries for the demonstration of working methods.

(*b*) A Department of Extension, which organises and equips dispensaries in various parts of the country.

(*c*) Nursing, which maintains training schools for public health visitors and supervises their work.

(*d*) Education, which organises exhibitions, holds meetings and distributes literature. It makes use of the cinematograph as an agent in its propaganda. Without some such outside aid, and the League of the Red Cross Societies at Geneva should not be forgotten in this connection, I fear there will not be much progress made in combating tuberculosis in the smaller towns and in the rural districts. In Port Louis, however, benefit may be expected to accrue from a tuberculosis dispensary run on proper lines and working in conjunction with the new tuberculosis wards now in course of construction at the Civil Hospital.

TYPHUS FEVER.

Typhus fever.

Although lice are very prevalent no definite evidence is forthcoming to show that typhus fever exists or has existed in Mauritius. Typhus, however, is not an easy disease to diagnose in persons with dark skins, and unless one has had previous experience of it in natives, it may easily be missed. The fact that so much typhus occurs in South Africa makes it highly desirable that the Port Health Officer, Port Louis, should be on the *qui vive* as regards the possible danger of the introduction of the typhus virus into Mauritius.

Danger of invasion from South Africa.

This is the more necessary, for if typhus once gained a footing it would probably be difficult to eradicate, as, to all appearance, the conditions would favour its rapid diffusion.

UNDULANT FEVER.

Undulant fever.

There are a good many goats in Mauritius, and upon enquiry I found that their milk is to some degree consumed by their owners, though apparently it is not sold to any extent. Towards the end of my visit a fairly definite record was obtained of the case of an Englishwoman who suffered from an obscure fever in the Island. She had to leave it on account of ill health, and on arrival, either in South Africa or Europe, the condition was found to be Malta fever. There seemed to be no doubt that infection was acquired locally. Hence it is more than likely that undulant fever occurs in Mauritius and is confused with chronic malaria or other forms of febrile disease. The laboratory at Réduit did not possess a culture of *Micrococcus melitensis* or a supply of diagnostic serum, but both should certainly be obtained and enquiries instituted.

Its probable existence in Mauritius.

VENEREAL DISEASES.

Venereal Diseases.

It is impossible from the published returns to gain any definite idea as to the amount of venereal disease in the Colony. There can be no doubt it is common, and some of the severer forms of tropical syphilis exist. Unfortunately very little is done in the way of combating these social evils and the treatment of syphilis, generally speaking, is not conducted on satisfactory lines.

Treatment.

I am informed that in the early days of the use of salvarsan, some regrettable accidents occurred, and that, as a result, modern anti-syphilitic treatment has never been properly established. Doubtless, also, the heavy expense of the latter has militated against its introduction, while the technique required has acted as a deterrent in the case of the outlying hospitals and dispensaries. Efforts must be made to bring Government hospital practice up-to-date in this respect and to institute suitable preventive measures. There are no Lock Hospitals, but in certain hospitals wards are reserved for the treatment of venereal diseases.

Necessity for Venereal Clinic.

In my second interim report I strongly advocated the establishment in Port Louis of a fully equipped Venereal Clinic, under the direction of a medical officer specially trained in anti-venereal work.

Useful sources of information.

Attention was directed to the Annual Report of the Chief Medical Officer, 1919-20, of the Ministry of Health, and to the International Journal of Public Health, Vol. II., No. 3, 1921, as sources of useful information and to the need of early treatment and of propaganda.

Conditions at the Port.

In my " Report on Communicable Diseases in Port Louis " I felt it my duty to draw attention specially to the disgraceful traffic which, I was credibly informed, goes on in Port Louis harbour, and which cannot fail to spread disease amongst sailors visiting the port. It is interesting to note that the Report of the National Council for Combating Venereal Disease for the year ending June, 1921, expressly states that the admission of known prostitutes to ships in harbour should be put down with an iron hand. Doubtless the recommendations of the Council, which has looked into matters in the Colonies, will be available in Mauritius, where it is so necessary to adopt energetic measures to deal with the social evil.

WORM INFECTIONS.

The rôle of parasitic worms in causing ill-health.

Ankylostomiasis and Schistosomiasis have been considered and incidentally mention has been made of Clonorchiasis, which merits much greater attention than it has hitherto received. The whole question of helminthic infections, however, requires careful consideration. Children especially suffer from these disorders, and such parasites as round worms and whip worms can no longer be looked upon with indifference. *Ascaris lumbricoides* is known to be a cause of debility in the tropics and may give rise to serious symptoms, sometimes simulating severe ankylostomiasis (Stiles). A form of fever due to its presence has been described in India. Tape worms, thread worms and *Strongyloides stercoralis* may all be a source of trouble and invaliding. I could find no evidence of trichinosis, despite the fact that pork is a common article of diet and, though food in some instances may be to blame, the great prevalance of helminthiasis is to be attributed in the main to faulty sanitary conditions.

OTHER DISEASES.

ALCOHOLISM.

Alcoholism.

Some may question the propriety of regarding alcoholism as a disease, but in its worst forms, when it has become an almost incurable habit, it must be considered a morbid entity, while, of course, it is closely associated with various pathological conditions. Unfortunately, the more severe forms of alcoholism are much in evidence. Formerly they were more or less limited to the Creole population, but latterly the habit of rum-drinking has spread to an alarming extent amongst the Indian and Indo-Mauritian population, and the Indian is less fitted than the Creole to withstand its ill effects. There can be no doubt that alcoholism is now one of the most frequent causes, directly or indirectly, of ill-health and loss of efficiency. This has at last been recognised by Government. In 1919 Sir Hesketh Bell appointed a Commission to report on the matter, and after an exhaustive enquiry it issued a report which has been published. Such portions of this valuable report as have a definite bearing on the public health are reproduced in Appendix IV.

A serious menace to the Colony.

Report of the Alcohol Commission.

The Commission reported that its inquiry shows conclusively the increasing peril due to alcoholism and that it is a matter of paramount importance that no pains should be spared in combating it. "The latter question," it states, "involves many conflicting interests, such as those of—

(1) The State, which derives an enormous revenue from the liquor traffic;
(2) Distillers, who sell their rum to the trade;
(3) Traders, who retail drink to the public;
(4) Planters, who supply distillers with molasses;
(5) Public Health, Labour, National Energy, etc.

To reconcile all these is no easy matter, but the time has come when facts have to be faced."

Reference to Appendix IV. will show the recommendations made. The principle of total prohibition was not adopted as an immediate measure, but a system of rigorous control was advocated, together with some very sound suggestions, amongst which one notes specially that the manufacture of some light drink such as "Kaffir" beer be encouraged.

Value of the Durban scheme.

It is greatly to be hoped that this proposal, amongst others, will be adopted, and if so, that careful consideration will be accorded the scheme of control first introduced in Durban and which has been imitated by several municipal bodies in South Africa.

The main feature of this scheme is the vesting in the Town Council of a monopoly for the entire control of the manufacture and sale of native beer.

All profits go to a special "Native Administration Fund" and are devoted to defraying the expenses and instituting various improvements in connection with the well-being of natives.

The maximum strength of alcohol permitted is 4 per cent. and native beer may not be sold to females or boys under 15 years of age.

In Durban the scheme has proved a great success and more than £110,000 have been devoted to improving native conditions by the establishment of schools and eating-houses and the erection of model dwellings.

The Colonial Office possesses reports on the working of the Durban scheme by Dr. Reford, of Uganda, and Dr. Paterson, of Kenya Colony, and these would doubtless be available for Mauritius.

It should be noted that one of the signatories of the Commissioners' Report tabled a dissent from certain of its findings. He was in favour of the total prohibition of the sale of rum, whisky, brandy and other beverages containing a high percentage of alcohol.

It is clear that the whole question is a very difficult one, but unless it is settled, and satisfactorily settled, the Colony is in danger of being ruined.

Chinese retailers of drink.

Most of the consolidated retailers are Chinese. They are good and peaceable citizens, but fatten on the proceeds of the sale of drink. Much of their gains is remitted to China and they contribute practically nothing towards the sanitary welfare of the Island, while their premises usually leave a great deal to be desired from the hygienic standpoint. If a sanitary tax is, as I think it must be, imposed, care should be taken that these wealthy Chinese pay a fair proportion, for a section of their trade has wrought much harm and their shops and houses are happy hunting grounds for rats. (Fig. 44.)

BERI-BERI.

Beri-beri.

In my second interim report beri-beri was classed as a communicable disease. There is some justification for such a procedure, for it seems more than likely that there are forms of polyneuritis included under the term beri-beri which are truly infective and the spread of which is favoured by overcrowding, filth and moisture, all of which are present in Mauritius and more especially in Port Louis. At the same time classical beri-beri, the food-deficiency disease, is the form most in evidence. It is endemic and every now and then attains epidemic prevalence. There was a small outbreak during my sojourn in the Island.

Acute anæmic dropsy.

A good deal has been written about Mauritian beri-beri and also about "Acute Anæmic Dropsy," which appears undoubtedly to have been the epidemic dropsy first noted in Calcutta and probably identical with the war oedema recently described in Central Europe, Palestine and East Africa.

Differential diagnosis.

Here it is only necessary to say that there seems good reason for believing that in Mauritius, as elsewhere, beri-beri is confused with other conditions, notably perhaps heart disease, malarial and alcoholic neuritis, nephritis and ankylostomiasis.

Association of beri-beri with rice.

After an enquiry into the causes of the outbreak and much kind help from Dr. Momplé, Mr. Walter and Dr. Tempany, I felt justified in recommending that only Big Mill Burmah rice be imported and that the introduction of a highly polished rice like that from Saigon be discontinued.

It is interesting to note that while the wealthier Chinese have a good and varied dietary, their poorer fellow countrymen feed chiefly on Siam rice which is highly milled, and, as a result, suffer a good deal from beri-beri.

I found that "Marmite" was used a good deal in its treatment, and apparently with some success.

NEPHRITIS.

Nephritis.

Nephritis accounts yearly for a considerable number of deaths and it is possible that some of it is to be regarded as a sequel to malaria. There is no doubt that nephritis in the tropics requires much more attention than it has received and a condition which annually kills nearly 300 people in Mauritius certainly merits investigation, even if, in a considerable proportion of cases, the etiology is apparent. Rojas and Marengo, in Guayaquil, have recently traced cases of nephritis in the tropics to infection with ankylostomes.

Its association with ankylostomiasis.

TETANUS.

Tetanus.

This is only mentioned in order to direct attention to the fact that an ample supply of anti-tetanic serum is stocked and that it is available throughout the Island. Under these circumstances it is distressing to find that a considerable number of persons (52 in 1919, 31 in 1920) die of tetanus every year.

MEDICAL FACILITIES.

Medical facilities.

Under this general heading I propose to consider the hospital and dispensary provision, its state of efficiency, the subordinate medical staff, its work and training, the question of infirmaries, orphanages and crèches, maternity and child welfare work with, as its natural corollary, the medical inspection of schools.

All these matters have already received some attention in interim report No. 8. Indeed, hospitals were considered in some detail and there is no need to repeat much of what was said. On the other hand it seems advisable to deal a little more fully with the subordinate medical staff and its duties than was possible in a mere interim report.

HOSPITALS.

Hospitals. Classification.

The hospitals in Mauritius may be placed in three categories—(1) Those under Government and managed and controlled by the Medical and Health Department, (2) Those attached to sugar estates, (3) Private hospitals. In addition there are infirmaries which are rather homes for the aged and infirm than actual hospitals though many of their inmates must be classed as "patients" in the accepted sense of that term.

Government Hospitals.

Plague lazarettes.

Emergency plague hospitals.

Taking first the *Government Hospitals* we find that the provision for the isolation and treatment of the more important and dangerous communicable diseases is quite inadequate. There is no general infectious diseases hospital in the Colony. The only communicable diseases for which special housing accommodation has been provided are leprosy and plague. The so-called leper asylum at St. Lazare has already been made the subject of comment and criticism. So far as plague is concerned there is a large lazarette at Grand River, North West. It covers a considerable area of ground and is a useful property. The buildings are in fairly good condition and there is plenty of room. It is conveniently situated, though there is a good deal of malaria in the neighbourhood, and part of it might with advantage be utilised as an Infectious Diseases Hospital for Port Louis. The portion where plague is now treated could, for the present, be reserved for that disease, though it is advisable to treat plague, and especially pneumonic plague, in a special hospital placed in an isolated position. Still a high wall separates the two portions and there need be no communication between them as each has its own entrance. If, however, human plague is stamped out of the Island, and in view of recent experience this would not appear impossible, then the best thing to do would be to turn the whole of the plague lazarette into an infectious diseases hospital where cases of enterica, dysentery, diphtheria, cerebro-spinal meningitis and, if necessary, small-pox could be treated and to erect temporary plague hospitals when required. As in Egypt so in Mauritius, it would be possible to keep emergency portable hospital equipment in stock. A plague hospital need not be an elaborate structure and poilite sheeting, which can be easily disinfected, is a very suitable material in a country where there is, at times, heavy rain. It is true that part of the plague lazarette buildings would require considerable alteration before they could serve the purpose of a modern hospital. I refer to the section which at present is employed for the segregation of contacts. Such segregation can, however, only be carried out to good effect under certain conditions, as when some special area like a labourers' camp is attacked and in any case a temporary segregation camp could always be erected in case of need.

Isolation hospital for Port Louis.

I am aware that I am advocating a change which will cost a good deal of money, and which some may regard as unnecessary, but I cannot think it right that a large town like Port Louis should have no infectious diseases hospital, and experience has shown that in the tropics it is highly desirable to treat maladies like typhoid fever and dysentery in a special hospital, and not, as is the case in Mauritius, either in the wards of a general hospital, or in special wards of such a hospital or in temporary huts in the hospital grounds.

There are plague lazarettes at Souillac and at Poudre d'Or, but both have fallen into a very bad state of repair. Instead of allowing buildings of this kind to remain *in situ* until they become ruinous, it would better to dismantle them and hold them in readiness for plague outbreaks, care being taken to protect the concrete floors of the wards.

Isolation hospital for Curepipe.

There should be some kind of isolation hospital at Curepipe. This large town has no hospital of any kind and the suggestion has been made that it may be possible to acquire the abandoned military hospital at the Camp, an excellent building, well designed and well built. There is a capital isolation block in connection with this hospital which would be very useful.

Elsewhere it will, I fear, be necessary, owing to lack of funds, to carry on as at present. The triangular wooden huts (Fig. 54) used for the isolation and treatment of " enterica " cases at the different general hospitals are certainly not very suitable but are better than nothing.

Necessity for special wards in hospitals.

Special wards should always be set apart for dysentery cases, and there should also be special tuberculosis wards like those in course of erection at the Civil Hospital, Port Louis. These desiderata, however, can scarcely be attained at present for the general wards are nearly always crowded, and funds are not available for building purposes. All that can be done is so to improve hospital hygiene that the risk of transmission of infection can be reduced to a minimum. A good deal can be accomplished in this direction, especially in the case of some of the general hospitals.

List of general hospitals.

Of these there are eight, namely, Civil Hospital, Port Louis; Barkly Asylum, Beau Bassin; Mahebourg Hospital; Souillac Hospital; Poudre d'Or Hospital; Flacq Hospital; Moka Hospital; and Long Mountain Hospital.

The new Victoria Hospital at Candos is nearing completion and by the time this report appears should be in use.

Hospital deficiencies.

As stated in interim report No. 8, Moka (Figs. 49-50) is much the best of these Government hospitals and the Barkly Asylum, Beau Bassin, the worst. Though good work is done at the Civil Hospital, Port Louis, the buildings are not altogether suitable, and the medical staff is quite inadequate. The others vary but, taken as a whole, the conditions are far from satisfactory. One cannot view with equanimity the lack of such hospital essentials as microscopes, laboratories, laundries. incinerators, disinfecting apparatus and ambulances. As has been said it is distressing in an old colony like Mauritius to find so much that is faulty and out-of-date.

There must be a general quickening and a strenuous effort must be made to obtain reasonable efficiency.

This applies not only to hospital equipment but to methods of treatment and the keeping of records. It is a pity that the Mauritius Royal Commission, 1909, discouraged the publication of reports on special cases. The slight saving in expense is more than counterbalanced by the ill-effect such a measure has on the keenness of the medical officer and his interest in scientific work. It may be argued that the medical press is at his disposal, but this is not quite the same thing as a record in a local report, especially in a place like Mauritius, which is, unfortunately, out-of-touch with centres of medical activity. Every hospital should have a small but comprehensive

Hospital libraries.

library of recent standard works. I am glad to say that on my recommendation a copy of the "Medical Annual" is to be supplied yearly to each of the Government hospitals. Save in the Civil Hospital, Port Louis, and the Moka Hospital, surgery and modern surgical procedure are, I understand, little practised, and there is great need for an improvement in this as in other directions.

Provision of microscopes essential.

The microscope must be more used. Of the eight Government hospitals, only four possessed efficient microscopes, and in two of these four very little microscopic work was done. This is not surprising, for the medical officers had too much to do and even had they been expert microscopists could not have found opportunities for much microscopy.

Resident Medical Officers from India.

It was on this account and also to ensure better medical and surgical attention for the patients and a closer supervision generally that I recommend the appointment of resident medical officers. I am of opinion that there should be a resident physician and a resident surgeon in the Port Louis Hospital and one resident medical officer in each of the other hospitals. At first I temporarily excluded Mahebourg and Souillac Hospitals from the scheme but now feel that they should also be included, for the importance of securing for the patients as soon as possible the benefits of accurate microscopic diagnosis cannot be gainsaid. Finding there was no possibility of recruiting these resident medical officers locally, partly because Mauritian doctors would not accept such posts at the salaries befitting the latter, and partly because very few Mauritian doctors were qualified to undertake modern tropical clinical microscopy I suggested that a number of young and keen Indian Medical Officers specially trained in such work should be obtained. (*Vide infra.*)

They would act as assistants to the present medical officers who, ranking in future as Provincial Medical Officers, would assume visiting and consulting functions.

Examples were given showing how essential it was that there should be resident medical officers in all the hospitals both for emergency work and to place on a sound basis the diagnosis of malaria and dysentery, to mention only two out of many diseases.

Subordinate Hospital Staff.

The subordinate hospital staff varies according to the size and importance of the institution, but the following posts exist:—

Stewards, who may also be either accountants or dispensers, pharmacists, dispensers, assistant dispensers, store-keepers, who sometimes act also as accountants, head warders, warders, nurses and sisters of charity. In addition there is a surgical assistant in the Civil Hospital, Port Louis, and in this hospital, as well as in most of the others there are students. These students, the majority male, but a certain number female, attend with a view to being trained as dispensers, warders and nurses. So far as training goes these three terms denote one and the same thing. To quote for a moment from my last interim report, it may be said that—

Students.

Training.

"Owing to the exigencies of the situation in the districts, especially as regards the Government and sugar estate dispensaries, it has been necessary to create a kind of hybrid post so that the students all receive the same instruction and are qualified to act either as dispensers or nursing orderlies (warders or "infirmiers"). The female students who become nurses undergo a similar course to that taken by the male students.

Dr. Rouget's syllabus of instruction.

I do not think this is a satisfactory arrangement, although I admit that, under existing circumstances, it cannot well be different, and that the course of tuition drawn up, obviously with much care and trouble, by Dr. Rouget, is, so far as I have been able to study it, a very complete compendium. At present only the first part of his syllabus of lectures has been published. The second is, I believe, in the press, and will deal, amongst other matters, with pharmacy and nursing.

The situation will be greatly changed if the sugar estates hospitals are abolished and then it should be possible to make a definite distinction between the dispenser and the male or female nurse. There is no need for the dispenser to learn half the things he is at present taught. Indeed, it is better he should not know them, for a little knowledge is a dangerous thing, especially in medicine and surgery. Apart from a thorough pharmaceutical training he need only be given instruction in first-aid. The ‘ infirmier ’ and the female nurse do not require an intensive knowledge of drugs and their uses but are very greatly in need of a sound and practical knowledge of nursing and hospital routine.”

Hospital servants.

Last, but by no means least, amongst the subordinate staff comes the hospital servant. There are various grades of the latter and a good deal depends on these humble employees. If properly supervised they are capable of doing excellent work and adding considerably to the comfort of the patients but they must be adequately paid and properly housed.

Hospital stewards.

Hospital Stewards hold responsible positions where they are exposed to temptation, and it is to be feared that, owing to insufficient inspection and control, matters are far from satisfactory in certain of the hospitals. A strong hand is badly needed and a searching enquiry into the whole question of hospital management should be instituted as soon as the new Director of the Medical and Health Department is appointed.

Pharmacists.

The pharmacist is really a senior dispenser, in receipt of a higher salary than a dispenser. There is only one at present and he is attached to the Civil Hospital, Port Louis. So far as I could see the hospital dispensers are on the whole a superior class to the dispensers serving the provincial dispensaries. They are as a rule better paid, especially those holding the posts of dispenser-stewards.

Nurses.

I found the nursing staffs everywhere under strength. They must be increased and every effort must be made to render them more efficient. Here and there good work is being done, but there is room for improvement, and improvement is more likely to be forthcoming when proper quarters are provided and the scale of pay revised. The question of a training school for a higher class hospital assistant has been raised and will doubtless receive attention.

Overseas Nursing Association.

A brief mention may be made of the excellent work which is being carried out by the Overseas Nursing Association, and it is hoped that arrangements may be made whereby the services of the nurses who work privately in connection with this Association will be available in such a Government hospital as that at Candos. This question is being made the subject of serious consideration.

Victoria Hospital, Candos.

Lunatic Asylums.

In the report on Medical Matters in Mauritius I entered into particulars regarding the new Victoria Hospital, Candos, the Lunatic Asylum, Beau Bassin, and, as an example of a private institution, the Chinese Hospital, Port Louis. It is unnecessary to repeat what was said. I can only hope that the remarks made with regard to Victoria Hospital and the Lunatic Asylum will have the effect of securing the improvements indicated.

Out-patient departments.

The value of out-patients departments is not sufficiently appreciated in Mauritius. Doubtless they have been somewhat neglected owing to lack of medical personnel and also owing to the presence of dispensaries. The out-patient department of a hospital serves, however, rather a different purpose than a dispensary, and is, or is at least should be, an economical method of treating minor maladies amongst the sick poor. It is essential, as Dr. Rouget stated, that there should be one in connection with the Civil Hospital, Port Louis. It could be placed under the charge of one or other of the Resident Medical Officers when they are appointed, as I hope they will be, at an early date.

Sugar Estates Hospitals.

Sugar Estates Hospitals.

A large number of these were visited and notes upon them will be found scattered through the series of Interim Sanitary Reports—Nos. 4 to 7, inclusive. Although here and there a hospital was found which it was a pleasure to visit, the majority deserved little commendation and some were places which did not deserve the name of a hospital. These were made the subject of special memoranda.

Recommendation regarding Medical Officers.

There can in my mind be no doubt that it would be a good thing if arrangements could be made whereby Government is given the control of the appointment of medical officers to these hospitals. This is most desirable in the interest both of the patients and the doctors and a proposal to the effect was made in September, 1921.

I do not know if any action has yet been taken. It is very probable that ere long the Sugar Estates Hospitals will have ceased to exist. The system of indentured coolies has come to an end and changes in the Labour Law will bring about greatly altered conditions, so that the sugar plantations will no longer be responsible for the housing and medical care of their Indian employees. As a result it will be necessary for Government to establish large hospitals in central situations throughout the districts.

H.E. the Governor having appointed me a member of a committee to consider the effect of the proposed changes in the post of Protector of Immigrants and other cognate matters, the above question was discussed and it was decided that in all probability the following places would be suitable as sites for the new District Hospitals :—

New District Hospitals.

(1) Rose Belle to serve Grand Port and part of Savanne.

(2) Rivière Seche (Flacq) to serve the neighbouring portion of Flacq and the eastern part of Moka.

(3) Mapou to serve portions of Rivière du Rempart and Pamplemousses.

(4) Bambous to serve Black River District.

It is to be hoped that before any of these hospitals are built the plans, with full particulars, will be submitted to experts, so that the errors of the past will not be repeated and that advantage will be taken of recent progress in hospital construction to ensure that the institutions are in every way suitable and as complete as the funds available will permit. Valuable information (with plans) regarding hospitals of the type required will be found in "Koeliehuisvestung en Geneeskundige dienst op. Rubberondernemingen," by E. P. Snijders.

DISPENSARIES.

Dispensaries.

The information regarding Government dispensaries (Fig. 51) contained in interim report No. 8 may be summarised as follows :—

(1) There are 22 dispensaries scattered about the Island. Two of them are in Port Louis, the others in the smaller towns and villages. Some are well managed, clean and tidy, and others very much the reverse. In few of them could the equipment be regarded as satisfactory.

(2) Their number is probably not sufficient, though much depends on the results of the measures which have been put forward for improving the present inefficient and wasteful system.

(3) The system is inefficient chiefly because the cases are not followed up at their own homes but also because proper facilities for diagnosis are lacking. Not a single dispensary in the Island contains a microscope.

(4) The system is wasteful because the results which should be obtained are in many cases not obtained and expensive drugs are dispensed to little or no good purpose.

(5) Many persons when ill receive no medical attention at all.

In one portion of the Flacq district it is believed that for 20,000 people there is no medical provision of any kind.

(6) The dispensaries do not serve as centres for the education of their clients in the more simple tenets of tropical hygiene. It is true that here and there illustrated posters explaining how malaria is spread are exhibited, and occasionally one may see a placard referring to the danger of promiscuous expectoration in cases of pulmonary tuberculosis, but a great deal more might be, and should be done, given a sufficient medical staff, keen on their work and anxious to aid the sanitary department.

Introduction of Indian Medical Officers.

(7) That medical staff can be obtained, like the Resident Medical Officers for the hospitals, from India. At present there is no possibility of obtaining it locally, but, in due course, Mauritian doctors should be available for the work.

(8) The dispensaries can be grouped in such a way that each dispensary doctor has two or three under his charge.

(9) He will be provided with a motor bicycle so that he will be able to pay daily visits to the dispensaries, and to get about his district, following up the cases and treating the sick poor in their own houses. He will carry with him not only medicines, dressings and instruments, but a microscope and facilities for clinical microscopy.

(10) He will be given quarters, preferably at the nearest district hospital, will not be allowed private practice, and his appointment will be temporary, say for a period of three years.

(11) He will work under the direction of the visiting Provincial Medical Officer and will be responsible for the state of the dispensary, controlling the dispensers and supervising the records.

It will also be his duty to preach the gospel of hygiene to his patients who, for the most part, will be like himself, of Indian birth.

No sooner had the scheme for the introduction of Indian Medical Officers been promulgated than it met with violent opposition from a body of the private practitioners of the Colony who constituted themselves a "Corps Médical." They could not deny the necessity for a thorough change in the existing dispensary system, they admitted the deplorable state of many of the country districts but they were not prepared to co-operate, and they feared the Indian medical men would settle in the Island at the termination of their contracts and cut into their practice. For a time feeling ran high, partly owing to misunderstanding and a lack of appreciation of what the scheme really meant. Eventually a meeting was convened where matters were fully explained and a more reasonable attitude was adopted.

Type of Indian Medical Officer required.

It has been arranged that, for a start, six medical officers from India will be introduced. Thanks to the kindness of Lt.-Colonel Megaw, I.M.S., the Director of the Calcutta School of Tropical Medicine, care will be taken to see that the men selected are of a good type, well trained in microscopic work, possessing a sound knowledge of tropical diseases, and likely to prove in every way satisfactory. Under these circumstances I see no reason why the scheme should not prove successful and bring much needed relief to the suffering poor, who at the time of my visit were dying in large numbers from influenza, pneumonia and other preventable diseases.

One cannot expect too much at first but, if it is given a fair trial, I believe the measure will justify itself. At any rate it is the only plan which could be devised to meet what was undoubtedly an emergency and a very serious state of things.

INFIRMARIES.

Infirmaries.

These are a number of institutes for the housing and treatment of aged and infirm paupers. The following is the list of those in receipt of government relief :—

List of Infirmaries receiving government relief.

Barkly Asylum.
Rempart Street Convent.
Calebasses Infirmary.
Pamplemousses Convent.
St. Julien Convent.
Chemin Grenier Convent.
Belle Rose Convent.
Signal Mountain Convent.

Most of them were visited and, in addition, an inspection was made of the clean and well managed Bon Secours Convent in Edith Cavell Street, Port Louis. Of the above, two of the buildings, *i.e.*, Barkly Asylum and Calebasses Infirmary belong to Government.

Recommendations regarding Infirmaries.

So far as the aided infirmaries are concerned I am in favour of leaving the inmates where they are and of increasing the government grant to these institutions. It is true that by establishing a large poor-law infirmary, say at Beau Bassin, it might be possible to obtain for the aged and infirm more efficient nursing and better sanitary conditions, but I fear that something else of value might be lost; a certain sympathy and kindliness and interest which stand for a great deal. After all, the infirmaries are for poor folk whose day is done. There is no chance of changing the derelict into a useful citizen, and I am inclined to think that the old people will be happier and more comfortable under existing conditions. At the same time these conditions should, as far as possible, be improved; in certain cases, they call urgently for remedy. This is more especially true of Chemin Grenier and St. Julien.

The Calebasses Infirmary (which is a government building) requires a more ample water supply and a dining-room, while the store rooms for wood and linen should be repaired. The infirmary at Pamplemousses should also be provided with a dining-room. In bad weather meals have to be eaten in the dormitories, always an undesirable contingency.

As I have mentioned Chemin Grenier and St. Julien, it may be well to give some idea of the conditions obtaining in these places.

CHEMIN GRENIER.

Chemin Grenier.

It is looked after by Sisters of Mercy. The buildings on the whole are poor and the sanitary arrangements are very bad. The bedding in the larger wards was dirty and flies were numerous. An enquiry as to food showed that only the cheapest and poorest class of fish could be purchased and altogether the infirmary did not create a favourable impression though apparently the most was made of the scanty funds available.

In one of the wards I found an advanced case of *Elephantiasis scroti.* In all probability the patient harboured microfilariæ in his blood, and was capable of infecting others but he had no mosquito net.

St. Julien.

At St. Julien the buildings were somewhat better, but the sanitary conditions were disgusting, and the dietary not very satisfactory, especially considering that the inmates were old and infirm. A little meat or fresh fish was allowed twice a week. For the rest the patients received rice, dry grain and salt fish.

It is very necessary that the Director, Medical and Health Department, should turn his attention to some of these places and do what he can to put them on a better footing.

ORPHANAGES.

Orphanages.

Those in receipt of government relief are as follows :—

List of Orphanages receiving Government relief.

Barkly Asylum.
Bon Secours Convent.
La Paix Street Convent.
Belle Rose Convent.
Plaisance C.M.S. Convent.
Signal Mountain Convent.
Plaine Magnien Convent.
Pamplemousses Convent.
Chemin Grenier Convent.
Sainte Croix Convent.
Rose Bell Orphanage.

Most of these were visited, and some of them were found satisfactory, but others were very much the reverse. Even the best were hampered by lack of funds, while the worst exemplify the evils which may arise when well-meaning persons without expert knowledge devote themselves to good works of this kind.

Necessity for medical inspection and improved dietary.

I found it necessary to report specially on two of the orphanages, and am glad to say that, in one case at least, measures were at once taken to put things right. All these institutions should be liable to periodic medical inspection, and, where necessary, their dietary scales should be revised. The value of earth nuts, *Arachis hypogæa,* as an article of diet should be borne in mind.

GOVERNMENT REFORMATORY AND INDUSTRIAL SCHOOL.

Reformatory and Industrial School, Rose Hill.

This institution, situated at Rose Hill, and at the time of my visit under the control of the Inspector General of Police, appeared to me to be exceptionally well managed, and the sanitary arrangements were as good as they could be considering that the initial system was faulty. The boys looked well fed, and I was informed were active and intelligent, contrasting markedly in this respect with some of the children in certain orphanages.

I believe this was largely due to the fact that their dietary was on the whole satisfactory. I attach the schedule :—

SCHEDULE F.

GOVERNMENT REFORMATORY AND INDUSTRIAL SCHOOL.

SCALE OF RATIONS.

	Tea after parade and drill.		Breakfast every day.		Lunch 12 noon.		Dinner.					
							Sunday, Tuesday, Thursday.		Monday, Saturday.		Wednesday, Friday.	
	K.	Grs.	K.	Grs.	K.	Grs.	K.	Grs.	K.	Grs.	K.	Grs.
Rice or Maize (1) ...	—	—	—	175	—	—	—	225	—	225	—	225
Dholl	—	—	—	045	—	—	—	045	—	045	—	045
Beef	—	—	—	—	—	—	—	100	—	—	—	—
Tripe	—	—	—	—	—	—	—	—	—	090	—	—
Salt Fish	—	—	—	030	—	—	—	—	—	—	—	060
Green Bredes * (including stalks)	—	—	—	125	—	—	—	—	—	—	—	—
Pot herbs	—	—	—	—	—	—	—	090	—	090	—	090
Pistachio Oil	—	—	—	007	—	—	—	007	—	007	—	007
Curry Stuff	—	—	—	—	—	—	—	001	—	001	—	—
Sugar	—	15	—	—	—	—	—	—	—	—	—	—
Tea	—	02	—	—	—	—	—	—	—	—	—	—
Bread	—	60	—	—	—	225	—	—	—	—	—	—

NOTES—(1) At the discretion of the Medical Officer, maize may be substituted for rice at the rate of 9 grams of maize to 10 grams of rice.

The weights are those of the uncooked ration on issue.

Salt shall be added in sufficient quantity in cooking all diets.

I think an improvement would be effected by allotting some of the comparatively large bread ration to the dinner hour. I have suggested to Colonel Godfrey that a stock-pot be kept with due precautions, and some soup, as well as bread, made available at the lunch hour.

CRÈCHES.

Crèches.

There exist in Mauritius two types of these institutions :—

(*a*) The Day Crèche (Fig. 52) installed on sugar estates where the infants and small children are taken in and cared for while their mothers are at work. Of this form I saw only one example, *i.e.*, on Riche en Eau Estate, Grand Port, but the example set by this estate should certainly be followed. The buildings, with the exception of the latrine, were suitable, the place was clean and the babies and children appeared well and happy. The conditions as regards food were also satisfactory.

(*b*) The Crèche, resembling, but not identical with an orphanage, where infants and small children who have lost their parents or other near relatives *from any cause*, are given a home. H.E. the Governor takes a great interest in this matter and has established a small crèche near the Civil Hospital, Port Louis. Another larger, more commodious and equally well-conducted crèche is that at Bon Secours Convent, Port Louis.

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* Leaves of *Solanum nigrum*.

Danger of enteritis

The danger in all crèches in the tropics is the risk of enteritis, as was painfully evident in connection with a crèche which formerly existed in Moka. Enteritis is the result of faulty sanitary conditions and errors in the choice, preparation and serving of food. The strictest cleanliness is required, especially as regards diapers, and the slightest divergence from proper methods may be followed by disaster.

In this connection attention was directed to an excellent paper on "Infantile Diarrhœa and Vomiting," by Sherwood, which appeared in the *Lancet* for April 24th, 1920, and which lays down stringent rules for the hygiene of nurseries.

Measures for combating enteritis.

So far as the question of diarrhœa is concerned, the points of importance were :—

(1) The food was kept in a larder and, except at meal-times, was out of all contact with the children and their service.

(2) A separate room was used for the changing of the napkins, and, where possible, a separate nurse for toilet.

(3) The nates were washed and bathed with a disinfectant.

(4) The nurses' and babies' hands were disinfected.

(5) The napkins were immediately placed in a disinfectant.

Commenting upon these five points, the author says :—

> "Considering again the relative importance of the five points given above, we see that the larder is but a means of preventing contamination of food by germ-laden dust and flies, and hence infecting the child; the separate room is but a matter of treating the child with the same decency and care as is meted out to the adult. If the washing of hands and nates were neglected, though the neglect would leave open a grave source of infection to the *individual* child, in the hot dry months the nates and hands are always damp to a greater or less extent with perspiration, and hence the fæcal matter does not so readily dry as to form a great danger to others. But the placing of napkins in disinfectant puts the largest and most easily dried source of infection of the community in general completely out of court, and it is for this reason that I consider this point of greater importance than the others as far as the safety of the many is concerned. It is interesting here to note that Holt states that 'the enormous increase in the number of cases occurring in the summer months does not have reference to any single form of diarrhœa, but to all forms'—a conclusion which I think adds emphasis to this point, since the dried fæcal material will disseminate many micro-organisms that inhabit the bowel."

With reference to vomiting, the system instituted was as follows :—

> "Any child vomiting acid vomit was *immediately* removed from the nursery by the person noticing it and taken to an isolation room; its clothes were removed and the child bathed completely. When this had been done it was put into clean clothes. No milk was given for several hours, and the mouth was washed out at frequent intervals with a solution of borax in water. This sterilisation of the mouth is essential, as otherwise the infected mouth would infect the sterile milk."

A further possible source of infection were the spots of clean milk which get unavoidably splashed on the child's clothing during feeding. As a prophylactic measure, when the children's clothes were laundered, they were, before being ironed, rinsed in borax and water; this precaution is particularly necessary in the case of bibs.

The use of this system provided a means whereby this dangerous complaint was held in check. Considering that the means used were those employed for the avoidance of bacterial infection and that they were effective, it may be urged that this is an indication of the infective nature of the disease.

In connection with this point the possibility of the parent or nurse as a source of infection has to be considered. It seems horrible to suggest that any of these people may be a cause of so dangerous a complaint in their offspring or charge, but unclean hands or face, a foul mouth or otorrhœa may well cause a disaster to the child. A case in point arose at the home. A child arrived in a pitiful condition due to gastric and intestinal disturbance, and in course of the routine was isolated and placed under the strict system of the home. As the child did not benefit in the usual manner, all possible causes for the persistence of the trouble were investigated. It was found that the mother was devoted to the child and was constantly kissing it. When examined she was found to have a mouth full of carious teeth. A promise was extracted that she would not kiss the child, and her teeth were attended to. The child's rapid recovery was the sequel.

It seems advisable to give these details here, for copies of back numbers of the *Lancet* are, I regret to say, not available in Mauritius, and in the future more crèches are likely to be established, especially if great attention is paid, as it certainly should be, to the next subject requiring attention.*

MATERNITY AND CHILD WELFARE.

Maternity and child welfare.

At this time of day it would appear scarcely necessary to comment upon the great value of attending to the health and hygiene of the expectant and nursing mother and of infants and young children. Yet it is only recently that the subject has claimed serious attention in Mauritius, where, according to the Registrar General's Report for 1919, there were 229 deaths associated with the puerperal state, the figure for 1920 being 146. There can be little doubt that these figures are below the mark, for many women receive no skilled aid in childbirth.

Infantile mortality.

The Registrar General reports that in 1919 there were 5,030 deaths amongst children under five years of age, this being 20·6 per cent. of the whole of the deaths in the Island, the corresponding figures for 1920 being 3,327 and 31·7 per cent.

The comparatively low percentage figure in 1919 is explicable in terms of influenza, which slew a large number of adults. As a matter of fact, the usual percentage of deaths in children under five years is about 31. This points to a very serious state of affairs and a study of the records from 1871 onwards shows that a large proportion of these deaths in children occurs in infants under one year of age. This is specially true of the Indian population, amongst whom the conditions are truly appalling. The infant mortality rate in Mauritius is higher than that in Trinidad, where since 1915 active steps have been taken to limit this waste of child life and also to safeguard the mother.

Comparison with Trinidad.

The de Chazal bequest.

The very high rate of infantile mortality in the Colony led Dr. E. L. de Chazal, in 1916, generously to present to the Mauritian Government the large sum of one hundred thousand rupees, with the request that it should be invested and the resulting income devoted to a scheme for the proper training of midwives, the establishment of a maternity ward at Victoria Hospital,

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* A recently published French work likely to be useful is "Science de l'Enfance, pour le développement général des Tout-Petits," by Madame Bérot-Berger.

Provision of midwives.

and also, if possible, of a ward for the treatment of infantile complaints, more especially disorders of nutrition and dietetic diseases. This munificent gift and the warm interest taken by H.E. the Governor in the scheme have enabled good work to be accomplished and trained midwives are now employed on a large number of sugar estates and are also available for work elsewhere.

When the Victoria Hospital is completed a further development may be expected, but it must be already a source of satisfaction to the donor to know that his liberality must have saved many lives and directed attention to the urgent need, not only for saving mothers and infants, but for securing the welfare of child life generally.

Appointment of lady doctor.

How best to follow Dr. de Chazal's lead and to organise an Infant Welfare Scheme applicable to conditions in Mauritius was considered in Interim Report No. 8, where an account was given of the measures instituted in Durban and a plea advanced for the early appointment of a Woman Medical Officer and the introduction of a few Health Visitors.

It was pointed out that Mauritius has never made sufficient use of the resources obtainable from South Africa, but it is also true that the medical authorities have to a large extent remained in ignorance of what is being accomplished elsewhere. The Baby Welfare League in Trinidad has rendered valuable assistance there and India has awakened to a sense of the enormous importance of saving infants and young children, as witness the Maternity and Child Welfare Exhibition at Delhi, 1920, and the course of lectures delivered both in English and Urdu.

It is high time the better classes in Mauritius took an active and intelligent interest in the matter. Many of the younger women have plenty of time at their disposal and were they to spare a little of it to help their less fortunate compatriots they would in no wise lose their reward, for the results would soon be apparent. They cannot, I think, realise the conditions which obtain, and the Church, which should act as a guide and mentor, appears like Gallio to care for none of these things.

There is a necessity, an urgent necessity, for plain speaking on this point, and those who benefit others in this respect in the long run benefit themselves and the country of which they are so justly proud.

Sources of useful information.

Government must, however, provide facilities for training and instruction, and hence, in the first instance, expert help must be obtained from lands which have begun to put their houses in order. As a guide to what is required, in addition to the sources of information already cited in Report No. 8, mention may be made of the paper by Pitt, entitled " Child Welfare Programmes," in the International Journal of Public Health, Vol. 2, No. 4, 1921. Copies can be obtained from the League of Red Cross Societies, Geneva.

MEDICAL INSPECTION OF SCHOOLS.

Medical inspection of schools.

After five years of age the growing child should come under the care of the School Medical Officer. In Mauritius this was not the case because no such official existed. And yet if ever School Medical Officers were required it is in this Colony, where the school buildings are, almost without exception, unsuitable, the sanitary state of schools a disgrace and a large number of the pupils the victims of parasitism.

School buildings unsatisfactory.

School absences due to illness.

The record of school attendances is suggestive, though it must be remembered that poverty, by depriving the pupils of proper clothing and making the parents ashamed of sending their children to school, is a frequent cause of absence. At certain periods of the year also the older children are withdrawn from the schools to work in the fields or elsewhere. Still, there can be no doubt that the chief factor is illness, which, unfortunately, some of the schools propagate along with the knowledge it is their duty to impart.

Average attendance.

In Report No. 1 on the Sanitation of Port Louis a table will be found kindly furnished me by Mr. A. M. Souter, Acting Superintendent of Schools, which shows that the average attendance of all those on the books of the 17 Port Louis Government and Aided Schools is 66·5 per cent.

During my inspection throughout the Island I took records of 63 similar schools, all of which were visited, and found the average attendance was 67 per cent.

Nearly one-third of the pupils in Mauritian schools are, therefore, constantly absent.

Malaria and ankylostomiasis are rife, schistosomiasis common in certain districts, and other worm infections numerous, scabies by no means rare, and pediculosis very much in evidence.

As has already been stated it is neither right, nor fair, nor wise, nor economical to let the children suffer from lack of medical control.

The chronic malarious child.

Taking only one aspect of the question we may note that Dr. Leipoldt, Medical Inspector of Schools in the Transvaal, states that "the chronic malarious child is so debilitated that his output of work is diminished by 75 to 90 per cent. and his physical strength by two-fifths as compared with a normal child of the same age living in a non-malarious district."

As a matter of fact in some of the schools in Mauritius I found chronic malarious children who were quite unfit to be at school at all, and should have been under treatment in a hospital.

Some had very large spleens which were a distinct danger as they might easily have been ruptured by a blow or fall. The matter was reported. I have written suggesting that the Mauritian Government put itself into communication with the Secretary of Public Health for the Transvaal with a view to obtaining copies of Dr. Leipoldt's report, of the model lessons for children and other practical educational propaganda which have been prepared.

Malnutrition.

It is not only a question of disease and verminous conditions. There is a great deal of malnutrition. Instead of plump well-fed youngsters one found time and again thin and sometimes even emaciated frames. One cannot rear good and efficient citizens from such a stock, and yet a very little care and attention would, beyond all doubt, work wonders. A first step has been taken by the appointment of a School Medical Officer in Port Louis. Unfortunately at present he has also to act as Port Health Officer, but at a later date a whole time School Medical Officer should be appointed. With the kind assistance of Dr. Gilchrist a schedule was prepared and in the future "as many children in Port Louis as possible will be examined in respect of general development, the state of their eyes, ears, throats, noses and teeth, presence of vermin, *i.e.*, pediculosis, scabies, presence of such skin diseases as ringworm, favus and impetigo, evidence of malaria, ankylostomiasis, schistosomiasis, worm infections and rickets."

School Medical Officer.

Schedule for examination of school children.

This is the thin end of the wedge and ere long it is hoped to extend the scheme to the districts, when the Medical Officers of Health (see p. 122) will be responsible for this work as part of their duties.

Within a short time a mass of valuable information should be forthcoming and, what is more important, there should be a steady improvement both in the bodily state and mental acumen of the pupils.

Personally I think the outlook is hopeful. One has not in the main to deal with the miserable wrecks of child life seen in the schools of the slums of great cities. Apart from the evil influence of poverty and consequent malnutrition the children suffer owing to the invasion of parasites. If this can be prevented and the parasites present expelled there is no reason, the original stock being for the most part healthy, why a strong, virile and intelligent race should not be reared. The future rests with the School Medical Officer and the Hygienist, provided their efforts receive support and encouragement.

SANITARY MATTERS.

Sanitary matters.

The above heading has been chosen after due consideration. Confusion often exists in the minds both of medical men and laymen as to the precise significance of hygiene and sanitation.

No better definitions of these subjects can be given than those advanced by Professor Whipple of Harvard University who classifies them as follows :—

Hygiene.

> "1. *Hygiene.*—This treats of the physiological relations of human beings to their environment, the influences of climate, mode of life and the effect of the conditions found in the home, the school, the factory and all other varied conditions under which people live, work and play. Hygiene differs from sanitation in that it approaches the environmental conditions from the physiological standpoint. Hygiene is often subdivided according to age, as prenatal hygiene, infant hygiene, child hygiene, sex hygiene, etc.

Sanitation.

> "2. *Sanitation.*—This also treats of environmental conditions, but it approaches them from the standpoint of the engineer. Sanitation puts into practice the ideas which hygiene suggests. It has to deal with the forces of nature, with materials, with the use of structures, and even machinery. Specifically, it includes such matters as the purification of water, the pollution of streams, the disposal of sewage, the removal of solid wastes, ventilation, plumbing, heating, lighting, the drainage of swamps, the construction of buildings to make them rat-proof."

It is, of course, the case that the two subjects are closely related and it is neither possible nor desirable altogether to divorce them.

Consulting Sanitary Engineer.

A good deal of what may be called hygiene has already been considered under the sections dealing with Communicable Diseases and Medical Facilities, while references to what is strictly speaking Sanitation have been made under Malaria and Plague. In the present section hygienic considerations cannot be wholly excluded, but in the main it will deal chiefly with questions in which the engineer is closely concerned, hence the title "Sanitary Matters." At the same time I do not propose to trench to any extent on the domain of the Sanitary Engineer. Mauritius has been fortunate in obtaining the services of Mr. E. L. Mansergh who, as stated, arrived a few days before I left the Colony. I had little opportunity of discussing matters with him prior to leaving, but he has recently returned to London, and I have had the advantage of hearing his views on the situation and studying some of his valuable reports. I am glad to find that we are in accord on all essential matters which form common ground for the engineer and the hygienist.

Before taking up the various subjects in detail it is necessary to consider the personnel available for sanitary work in the Island.

Sanitary Staff.

It has already been shown that, at the time of my visit, only four medical officers were concerned with sanitation, and of these three only were executive.

Originally four sanitary posts existed :—

Medical Officers.

Chief Sanitation Officer.
Sanitary Warden—North.
Sanitary Warden—Port Louis and Black River District.
Sanitary Warden—South.

To these may be added the posts of Malaria Authority and Port Health Officer, Port Louis.

Dr. Momplé, who was formerly Chief Sanitation Officer, had become Acting Director, Medical and Health Department, and so, of course, had sanitary matters and arrangements under his control.

Dr. Castel, who should have been the whole-time Malaria Authority, held that post and, in addition, the posts of Chief Sanitation Officer and Sanitary Warden—North. Dr. Keisler, originally acting under the term Medical Staff, as an Assistant to the Director, was functioning as Sanitary Warden, Port Louis and Black River District, and at the same time carrying out the duties of Port Health Officer, Port Louis.

In the absence of Dr. Masson the services of Dr. Chauvin, a private practitioner, had been secured as Sanitary Warden—South.

It is clear that such a senior staff was wholly inadequate for the work which had to be done and which, let it be remembered, included the supervision of sanitation upon the sugar estates, of which there are about 150, large and small.

Sanitary Inspectors.

Nor were conditions more satisfactory in connection with the junior staff. It is true there were 15 Sanitary Inspectors classed under three categories, and that 5 posts, 4 of which were filled, existed in Port Louis for Extra Sanitary Inspectors, but not one of these sanitary inspectors had any special qualification and, without exception, their training had been defective in many respects. Here and there one found a keen man interested in his work and doing his best under adverse circumstances, but the majority were inefficient, some crippled by illness, such as repeated attacks of malaria, some disheartened and discontent, some careless and ignorant.

There was a tendency for them to degenerate into mere recorders of nuisances. This is not surprising as frequently they had seen no results from their inspections and reports.

"Hope deferred maketh the heart sick," and again and again, owing to causes fully detailed in my third interim report, the unfortunate inspectors had witnessed urgent sanitary matters postponed or shelved until they despaired of getting anything accomplished.

Unsatisfactory conditions of work.

Moreover many of them were grossly overworked. I have cited one instance where a single sanitary inspector has under his charge a large and difficult district with a scattered population of 53,466, and another where the sanitary needs of a population of 31,692 have also to be looked after by a single inspector.

Considering the books and records which have to be kept, the paucity of proper office facilities, the dearth of good assistants and the lack of adequate means of transport, it is no wonder that the service is hopelessly inefficient.

Other factors militating against efficiency are :—

Factors militating against efficiency.

(*a*) The time which Sanitary Inspectors have to spend in Court giving evidence. One inspector informed me that he spends two whole days in such work every week.

(*b*) The fact that a Magistrate will sometimes dismiss a case unless the inspector is able to state that he has seen the nuisances forming the subject of prosecution the day before the trial. It is often quite impossible for him to do so, and the accused person takes advantage of this loophole of escape. The nuisance, seen by the inspector several days before the trial, has not been abated but the accused states that it has been remedied since the last inspection, and the Magistrate gives him the benefit of the doubt.

(*c*) The fact that the unfortunate Sanitary Inspector has to serve no less than four Departments, *i.e.*, the Medical and Health Department as regards his routine work, the Public Works Department with reference to straw buildings, the Department of Agriculture in respect of Surra and the Immigration Department so far as Indian Camps are concerned. We read in Holy Writ that no man can serve two masters. Still less can he serve four.

(*d*) The fact that Sanitary Inspectors are badly paid considering the responsible position they hold and the temptations and dangers to which their special class of work exposes them. It must not be forgotten that Sanitary Inspectors are often, or should be often, among the first to enter premises where there are cases of serious communicable disease as, for example, plague and influenza, yet they find it hard to live and have little to which to look forward.

Sanitary Guards.

Under the Sanitary Inspectors come the Sanitary Guards. There are 30 posts, seven of which were vacant at the time of my visit. In addition 31 extra Guards were employed in Port Louis as Disinfectors and of this number 10 carried out general sanitation work as required.

The term " Sanitary Guard " is a curious one and much of what has been said regarding the Inspectors applies equally to these employees.

Given proper training, better pay and a hope of advancement, the Guards might be turned into a useful body of assistants. I confess that during my inspections I could find but few results of their work, though some of them took copious notes.

Sanitary Engineers.

I found there was no Sanitary Engineer attached to the Medical and Health Department, a defect which has now been remedied.

Apart from some of the anti-malaria operations practically all the sanitary engineering work was in the hands of the Public Works Department. That Department is very much understaffed and overworked, and sanitary requirements are apt to be overlooked. Moreover it must not be forgotten that sanitary engineering is as much a special branch of engineering as, let us say, public health work is of medicine, and to get the best results, at least so far as minor requirements go, it is essential to have an engineer specially trained in sanitation. It is all to the good if he forms one of the staff of the Medical and Health Department, is available at any time for consultation, and is in a position to help the Sanitary Inspectors in their work.

Municipal control of sanitation in Port Louis.

The control of sanitation in the urban district of Port Louis was in the hands of the municipality. Conditions, at the time of my visit, were found to be in a most unsatisfactory state. This is not surprising, for the municipality possessed no trained executive. It was expected to take action on representations made by the Chief Sanitary Officer and the Sanitary Warden, but, though some good work, chiefly in the way of anti-malaria operations, had been accomplished in the past, it had proved itself quite incompetent to deal with a difficult situation and there was constant friction and endless delays. Moreover, taking Port Louis as a whole, a system of dual control had been established which worked very badly and militated heavily against efficiency.

Control exercised by Local Boards.

The same thing was true of Curepipe, Quatre Bornes, Rose Hill and Beau Bassin, where the control of certain sanitary works was vested in Local Boards. The difficulties and dangers of a system of dual control have been described in Interim Reports Nos. 1 and 3, and, as will be seen (p. 123), measures have been devised for abolishing this faulty system of administration and placing sanitation on a sound basis under the charge of competent experts and in the hands of Government.

Turning now to actual sanitary conditions, there can be no doubt that the most important are those concerned with water supply and the disposal of excreta. Accordingly these will first receive attention.

WATER SUPPLY.

Water supply.

In Mauritius water for drinking purposes is derived from various sources, and, generally speaking, the supply is ample, although there are areas where the inhabitants are hard put to it to find convenient sources of potable water. This is the case, for example, on some parts of the littoral of Rivière du Rempart and in certain localities in Flacq. By potable water, however, I do not mean pure water, *i.e.*, water free from specific contamination. Certain sections only of the population are in the happy position of being able to secure pure drinking water.

Yet it cannot be denied that Mauritius has done a good deal in the way of securing a first-class water supply.

Mare-aux-Vacoas reservoir.

So long ago as the early nineties of last century the large reservoir of Mare-aux-Vacoas was established in the rainy, uninhabited and lofty southern portion of the Plaines Wilhems District. Indeed, water was obtainable from the locality in 1887. The present catchment-area is 5 square miles.

This great body of water, fed by several streams, has been improved from time to time by clearing the reservoir of aquatic growth and by deepening it. The last work done was carried out in 1919 as a result of the reports of Mr. G. M. Harriott, C.S.I., C.I.E., an irrigation engineer who was obtained from India to advise on the matter, not, however, from the sanitary standpoint, but with a view to the provision of more water for irrigation purposes. The level of the water in the reservoir was raised 5 feet.

Water works at La Marie.

In 1894-5 the sand filter beds and reservoirs were constructed at La Marie under the direction of Mr. le Juge de Segrais, now the Director of Public Works, who has made a special study of water works engineering. In addition to well-constructed filter beds and methods of aeration, an Anderson's plant was installed to rid the water of organic vegetable matter which at times caused trouble, more especially when the reservoir was shallower than is now the case and at times of drought when its level was low. It has now but rarely to be put into operation.

A considerable quantity of unfiltered Mare-aux-Vacoas water is supplied to the large new irrigation reservoir of La Ferme.

Places supplied by Mare-aux-Vacoas water.

The filtered water is available, as a piped supply for Curepipe, Floreal, Vacoas, Phœnix and parts of Quatre Bornes, Rose Hill and Beau Bassin.

Steps had already been taken for an extension in the Plains Wilhems District at a cost of Rs. 65,000, and I strongly advocated carrying a pipe line from Quatre Bornes to Palma in the upper Black River District, where the water supply was very bad. This has been approved and can be carried out for Rs. 6,500. A pipe line at present furnishes water to Petite Rivière in this district and also to the lighthouse at Pointe-aux-Caves. The question of supplying the neighbouring Albion Estate at a cost of about Rs. 14,000 is under consideration.

An extension of the pipe system has been carried to Port Louis and pure water is supplied to Fort George, Fort Adelaide, Fort William, Line Barracks, Central Railway Station, Civil Hospital, Public Works Department, Government House, Central Police Station, Prison, Supreme Court, Colonial Ice Works, three aerated water factories and the leading restaurant, known as the Flore Mauricienne.

It is in some ways a pity that this excellent supply could not be made available for the whole Island, but the cost would be very great and in many places it would be difficult to obtain any financial return.

Extensions.

As Mr. Mansergh will report fully on the water supply question from the engineering standpoint, it is unnecessary for me to do more than state that it is hoped to furnish adequately all the five townships on the railway with Mare-aux-Vacoas water and to supply Port Louis and the shipping wholly from this source. The cost will be heavy, but it is essential that Port Louis be given good drinking water and that the greatest use possible be made of such a sanitary asset as the Mare-aux-Vacoas reservoir. The scheme will entail the provision of more sand filter beds and the construction of a number of service reservoirs, more especially a large, covered reservoir for Port Louis, which in my first Report I estimated should hold at least 3,000,000 gallons, for every large town should always arrange to have several days' supply at its disposal.(1)

Waste of water.

In order to prevent waste, which at present is so common a feature in the case of piped supplies in Mauritius (Fig. 65), it will almost certainly be necessary to introduce a meter system and a water-rate must be imposed.

The laying of mains and pipes.

The purchase and laying of mains and pipes will be an expensive item, and in view of what occurs at present I would lay stress on the necessity for having these mains and pipes properly laid underground. During a great part of their course along the flank of Signal Mountain the ordinary and rectification mains which at present carry Grand River N.W. water to Port Louis are only partly buried. Leaks occur and tiny pools form in which *Anopheles costalis* breeds. Again, as Fig. 66 shows, it is not infrequently the custom to lay water-pipes on supports above ground. In the summer the water in these pipes is exposed to a very hot sun and the result of providing a tepid and unpleasant supply to a native population may be to drive the latter to have recourse to some cool but possibly polluted water. This has happened in India.

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(1) The Mansergh report recommends pressure filters in preference to sand filter beds and fixes the capacity of the new Port Louis reservoir at 6,000,000 gallons, provision being made for a more liberal water-supply than I had ventured to suggest.

On both counts, therefore, it is highly desirable that, unless there is some very special reason to the contrary, both water mains and pipes should be bedded underground.

Necessity of care as regards filter sand.

Another point to which I must refer is the necessity for exercising care in the transport and handling of filter sand from the sea coast to La Marie. I was informed on good authority that any kind of railway truck available at the moment is employed and that upon occasion the sand has actually been conveyed in waggons which had previously contained manure, and had not been properly cleaned.

The sand is, of course, carefully washed before use, but it is tempting Providence to subject it to such risks of contamination.

It is very desirable that trucks should be reserved solely for the transport of filter sand.

Transport of water pipes.

Care should be taken also to see that water pipes are transported in waggons which are clean.

Another matter requiring attention is the risk of pipe contamination during laying or repairs.

The danger of infected water pipes.

Although it is difficult to be quite certain I strongly suspect that an outbreak of enteric fever which occurred in Curepipe during August and September, 1921, was due to this source, especially as I found that no precaution is taken to clean water pipes before they are laid. In a country where there cannot fail to be many typhoid carriers and where soil pollution is common, it is obviously necessary that special care is required during such operations.

Analysis of Mare-aux-Vacoas water.

The analyses of unfiltered and filtered samples of the Mare-aux-Vacoas water carried out at the Réduit laboratory show that, as a rule, it is above suspicion, *B. coli* being absent from 100 c.c., but the examinations in the past have been made at rather infrequent intervals. It would be advisable in the future, especially in view of the additions which will have to be made to the filter beds, to arrange for a more frequent routine examination of this water and it would be well to examine samples before and after filtration. In the past the Staff of the laboratory has been much too small to deal properly with these water questions but if the proposals put forward on p. 130 of this report are accepted it should in the future be possible to accord them the attention they certainly deserve.

Other sources of water.

Apart from Mare-aux-Vacoas the sources of water supply are as follows :—

Rivers, streams, canals.

(1) *Rivers, Streams and Canals.*—The lower class Indian always prefers to drink from flowing water and he takes what is most convenient without any consideration as to whether it is even reasonably pure.

Accordingly a large number of the population imbibe what can only be termed liquid filth for the smaller streams and canals are often grossly polluted. They do so with comparative impunity until specific infection of the water occurs, as is always liable to be the case, and then they too often fall victims to typhoid or dysentery. The rôle of contaminated water supplies in the causation of ankylostomiasis has never been properly worked out in Mauritius. Infected soil is certainly the chief medium but water may play a considerable part. It certainly does so in the case of some other helminthic infections, notably schistosomiasis.

Fouling of streams

It is sad to see how the beautiful rivers and hill streams of the Colony have in many instances been fouled by the washing of clothes in them (Fig. 106), and by the drainage into them of all manner of filth. This is, of course, specially true where they course through townships like Curepipe. Some of them are little better than open sewers, for they receive the washings from cowsheds, latrines and other noxious effluents. In certain parts of the Island also the discharges from sugar factories still find their way into water courses

Existing supplies.

This state of matters makes the water supply problem difficult for, even if pure water can be furnished, there is nothing to prevent the coolie having recourse to the polluted stream. Education alone will combat this tendency which cannot be checked in a short space of time. Still it is no argument against the provision of pure water, and it is gratifying to find that serious efforts have been made to furnish this commodity often at considerable expense.

There is, for example, the supply of Rose Belle, Grand Port, derived from the Rivulet Casse Couteau, a feeder of the Citron River at a place far removed from any human habitation and traffic. The only possible source of contamination would be from " chasse " parties but the risk is slight.

An even better supply is that of Souillac in Savanne. It is piped from a somewhat inaccessible reach of the Savanne River high up in the hills above the Cascade Cecil and is satisfactory both as regards quality and quantity.

Yet other examples are seen in the Dubois River supply for Central Flacq, and the Jamblon River supply to the upper part of Flacq District.

Mahebourg also furnishes an example of a town supplied by pipe from uncontaminated hill streams but, as stated in Report No. 4, the intakes are not quite satisfactory, being, in two instances at least, too close to the Cluny Road.

Port Louis supply.

The chief supply for Port Louis is derived from Grand River N.W. (Figs. 55-56), is unpurified and is highly unsatisfactory. The subsidiary suburban supplies derived from the Bathurst and Dayot Canals are even worse and should be altogether abolished.

The Grand River supply was dealt with in Interim Report No. 1, and will form the subject of an important communication by Mr. Mansergh.

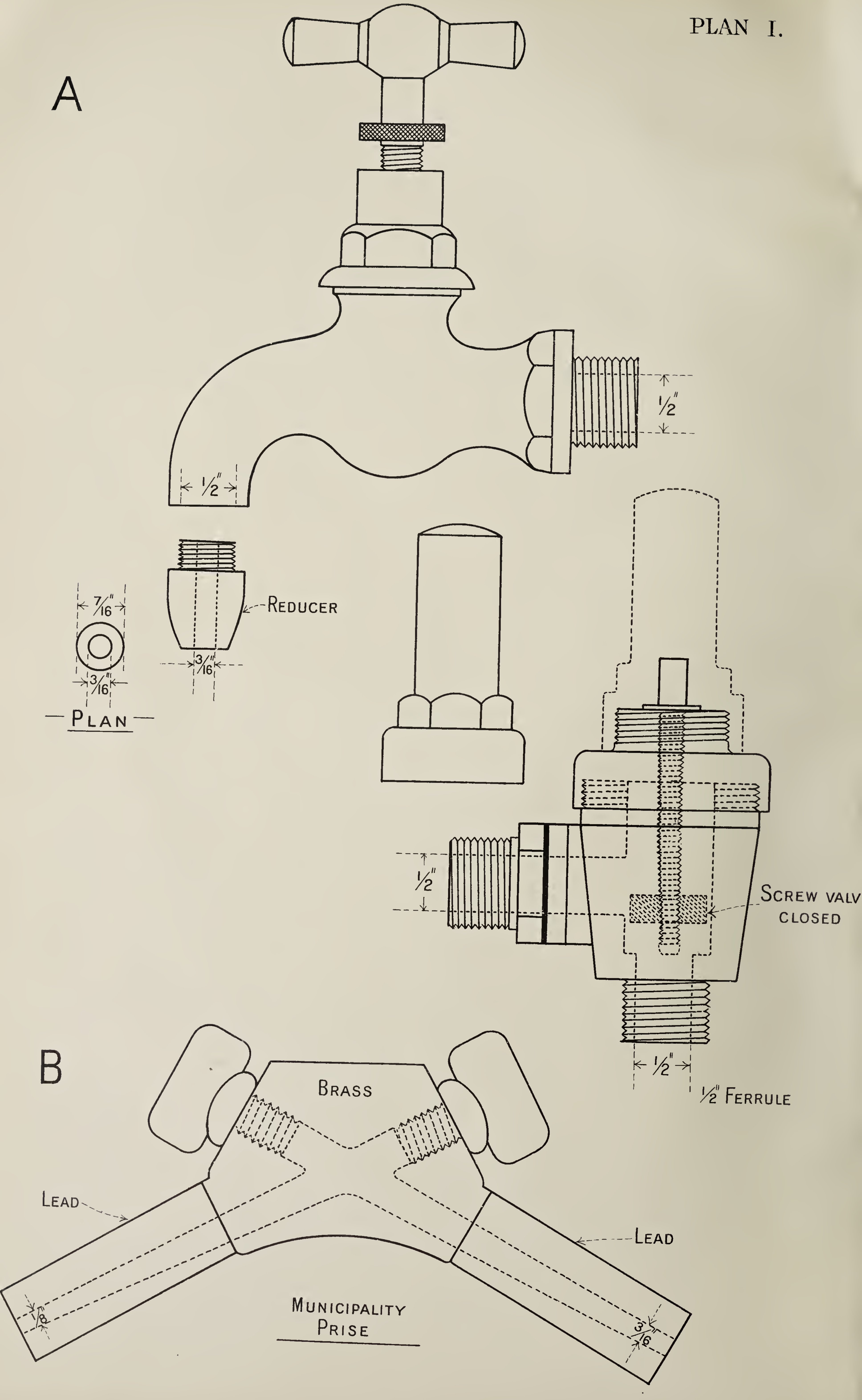
Analysis of Grand River (N.W.) water.

At the time of my visit I commented on the paucity of information as regards the chemical and bacteriological analyses of this water and stated that I hoped arrangements would be made whereby a proper series of tests could be applied to it for a period of at least 6 months. I am glad to say a chemist was appointed to the laboratory staff and that, before I left, Dr. Barbeau had already obtained some suggestive results.

These and subsequent data were furnished to Mr. Mansergh and, thanks to his kindness, I am able to insert them here.

WATER FROM GRAND RIVER NORTH WEST ABOVE MUNICIPAL DAM.

Date 1921.	Physical Properties	Chemical Analysis.							Bacteriological Examination.		Conclusions.
	Description of Sample.	Grains per gallon.		Parts per million.			Parts per 100,000.		Bacterial Count.	Indicators.	
		Solids.	Cl.	Free NH3.	Alb. NH3.	Oxy. Consd.	Nitrates.	Nitrites.			
9.8	Sample taken at 2 p.m. Clear, faintly yellow, no smell, Temp. 21° C. Slight deposit on standing 16 hours.	6	1·2	·04	·25	3·5	Traces	Not determined	184 aerobic bacteria per c.c.	Bac-Coli Communis (Escherich) (saccharose) + 5 c.c.	Markedly suspicious both chemically and bacteriologically.
23.8	Sample taken at 2 p.m. Clear, colourless, without smell, Temp. 21° C. Slight sediment on standing 16 hours.	8	1·3	·05	·14	2·1	·28	Traces	265 aerobic bacteria per c.c.	Bac-Coli Communis (Escherich) (saccharose) + 5 c.c.	Suspicious both chemically (less so than previous sample) and bacteriologically.
7.9	Sample drawn at 2.45 p.m. Clear, colourless without smell, Temp. 22° C. Slight greyish deposit after standing overnight.	8·2	1·4	·03	·09	?	Traces	Traces	109 aerobic micro organisms per c.c.	Bac-Coli (saccharose) + 5 c.c.	Suspicious both chemically and bacteriologically.
11.9	Drawn at 2.30 p.m. Clear, colourless, no smell, Temp. 20°·5C. Slight greyish powdery deposit after standing overnight.	10	1·5	·05	·10	1·5	Traces	Traces	174 aerobic micro-organisms per c.c.	Bac-Coli (saccharose) + 5 c.c.	Suspicious both chemically and bacteriologically.
5.10	Sample drawn at 3 p.m. Slightly opalescent with fine brownish particles in suspension. No smell, Temp. 21° C. Some brownish deposit after standing overnight.	7	1·2	·04	·13	2·1	Traces	Traces	196 aerobic micro-organisms per c.c.	Bac-Coli (saccharose) + 1 c.c.	Suspicious chemically and showing obvious indications of contamination bacteriologically.
18.10	Water clear, colourless, without smell, Temp. 23°·5C. Fine powdery deposit after standing overnight.	7	1·3	·05	·12	2·1	·03	Traces	335 aerobic micro-organisms per c.c.	Bac Coli (saccharose) + 5 c.c. Bac-Coli (saccharose) + 1 c.c.	Suspicious chemically and showing obvious indications of contamination bacteriologically.
7.11	Water clear with faint brownish colour without perceptible smell, Temp. 25°C. Slight flocculent deposit after standing overnight.	11	1·3	·04	·14	2·8	Nil.	Faint Traces	173 aerobic micro-organisms per c.c.	Examination in progress. Lactose fermenter with gas + 5 c.c.	Same as above chemically and also bacteriologically should the lactose fermenter prove to be Bacillus coli.



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Purification.

As it will take some considerable time before Mare-aux-Vacoas water will be available for Port Louis generally and as it is exceedingly undesirable that the present supply should be continued with all its silt and impurities, I recommended that, as a temporary measure, it should be purified and indicated how this could best be done. It is a question of rough filtration, chlorination and storage, the last named being necessary to get rid of the cercariae of *Schistosomun haematobium* which chlorination, as usually employed, will not kill. I pressed for the speedy introduction of a chlorinating plant, and I sincerely hope the recommendation has been acted upon, as the conditions of water supply in Port Louis are very disquieting and may easily at any time lead to an outbreak of disease. As schistosomiasis does not bulk very largely the question of storage may be discarded and rough filtration and chlorination alone adopted, for the real danger lies in the risk of outbreaks of enteric fever and dysentery.

Details regarding chlorination are given in Interim Report No. 1 and I understand that Mr. Mansergh, who has made a much more intensive study of the conditions than I was able to do, is in general agreement.

He will report fully on the question of distribution.

The " Prise " system and "Regards."

Here I would only make brief mention of the troublesome " prise " system which occasions the presence of the " regards," those nuisances in the streets of Port Louis which provide abundant breeding places for mosquitoes.

The " prise," a term which originally meant the right of a householder to a certain quantity of water, has come to be applied to the pipe contrivance which, situated in a small masonry well (" regard "), in the public thoroughfare, is constantly getting blocked with silt and subsequently damaged so that leakage occurs and a water collection forms. The covers of " regards " are frequently broken or lost and no sooner is a damaged " prise " repaired than it is again tampered with, so that the nuisance is never-ending. It is amazing that these " regards " have been allowed to persist for so many years, especially as they formed the subject of unfavourable comment by Ross and Fowler, and as I found that there was no great difficulty in replacing the " prise " system by an arrangement which abolished the " regard." Plan I. Fig B shows the pipe arrangement in the " prise " system and a consideration of the pipe diameters will show how easily blocking with silt can take place at the junction of the water supply pipe from the street main with the supply pipe to the house. Plan I. Fig. A indicates the screw-down ferrule which, placed wholly underground will replace the "prise" system and the "regard" and which can only be handled by employees of the Water Section of the Public Works Department. It will be seen that a reducing nozzle is fixed on the house tap to check waste.

Replacement of " Prise " system by ferrules.

I owe the plan to Major Regnard, R.E., the Assistant Director of the Department, and it was he also who originated the idea which A in the plan illustrates. One of these ferrules was in use before I left and was proving satisfactory. I understand that Mr. Mansergh approves the scheme and so it is to be hoped that ere long all the " regards " in Port Louis, and there are nearly 4,000 of them, will be things of the past. Their abolition will undoubtedly help to bring about a notable diminution of culicinae. stegomyiae, anophelines and malaria.

The provision of pure water to Port Louis and the prevention of the waste of water should make a very great difference to the health of its inhabitants. It is one of the most important of the sanitary measures required in Mauritius and has a strong claim on the Improvement and Development Fund, a claim which, as will be seen, has been duly recognised (p. 138).

In other places the necessity for securing good and adequate supplies of water for large centres of population had been recognised.

Water supply schemes.

Flacq.

I found schemes had already been put forward for the supply of :—

(*a*) The villages of St. Julien, Medine, Camp de Masque, Camp Sonah, Mère Jacquot, Clémencia and Mont Barbeau, all situated in Flacq, and containing a joint population of 11,365. It is proposed to take water from the unpolluted Monneron River which rises in the Government Forest of Vuillemain.

(*b*) The villages of Montagne Blanche, Petit Paquet, Hewetson, Sans Souci, Lesur, Sebástopol and Clavet, all, except part of the first named, also in Flacq. In this case the source is the Vaquoas River, which also has its origin in the Vuillemain Forest. Nearly 10,000 people would thereby benefit.

Moka.

(*c*) Quartier Militaire and the higher parts of Providence in Moka from the St. Martin stream, the catchment area of which would require protection.

Grand Port.

(*d*) The villages of l'Escalier, Union Vale, Beau Fond, Malakoff, La Baraque, Vieux Grand Port, Bois des Amourettes and a few smaller places all situated in Grand Port. It is also intended to improve the supply for the Town of Mahebourg. Practically all the above villages will draw their water from hill streams.

The Flacq, Moka and Grand Port schemes, which all appear to be quite sound and very necessary, are estimated to cost Rs. 400,000. The expenditure has been approved by the Council of Government and is to be met from the Improvement and Development Fund. (See p. 134.)

Savanne.

The above, however, does not represent all that is required in the way of water supplies from uncontaminated flowing streams. In Savanne it is desirable that the villages of Camp Diable and Chemin Grenier should be supplied, the former from the Rivulet Casse Couteau, the latter from some stream in the hill range traversing the south western portion of the district.

Another matter requiring attention is the adequate protection of catchment areas. At present these are unlikely to prove sources of danger but, in the future, care should be taken to safe-guard them, especially as the water from the rivers and streams is not artificially purified. In some places chlorination might with advantage be instituted.

SPRINGS.

Springs.

Plessis Spring, Pamplemousses.

These not uncommonly are sources of supply in Mauritius and often yield excellent water. Some of them have been protected against contamination, others require attention as, for example, the Plessis Spring which supplies water to Pamplemousses Village. It is formed by a discharge of underground water but the latter is very superficial and is liable to contamination from surface washings. The area of the spring itself has been roughly covered over but, at the time of my inspection, the supply was not sufficiently protected from contamination. The closing in of the spring itself with cement concrete was found to be an insufficient measure. The recommendation was made that the catchment area extending to some six arpents ($5\frac{3}{4}$ acres approx.) should be enclosed, preferably by a barbed wire entanglement.

Black River District.

Excellent spring supplies, not yet properly utilised, exist at Bambous and Casela in the Black River District, but a scheme has been devised for furnishing water from the perennial Eaux Bonnes Springs (Fig. 57), to Bambous, Medine Village, Sugar Estate and Railway Station, La Mecque, Anna Estate and Camp. Details are given in Interim Report No. 6. It should be possible to supply 4,000 people at an approximate cost of Rs. 30,000. The Casela springs are very similar to those at the base of St. Pierre Mountain, Bambous, and should be utilised to supply the small villages of Casela and Clarens and possibly also Flic-en-Flacq. The cost would probably be about Rs. 5,000.

Other spring supplies will be found mentioned in the interim sanitary reports and I would direct special attention to the remarks made regarding the curious underground spring supplies at La Caverne in Vacoas (see Report No. 3, p. 20), and the two "Les Caves," one near Grand Gaube in Rivière du Rempart and the other in Flacq. (See Report No. 5, pp. 2 and 9.)

La Caverne. "Les Caves."

It is very necessary that these important supplies should be efficiently safe-guarded.

An interesting spring, the water from which is supplemented by sub-soil channels laid in a natural basin formerly a swamp, exists at *Bassin Louploup* in Pamplemousses. The water from this source, which is not liable to contamination, supplies the whole of the Long Mountain District.

Bassin Louploup.

WELLS—(Figs. 59-62 and 64).

There are still a great number of wells in Mauritius, more especially in the less rainy districts like Pamplemousses and Rivière du Rempart. Most of them are shallow. Indeed it should be noted that the Public Works Department possesses no deep boring plant. Such an outfit would, I think, certainly be an acquisition. Some of the wells are very large and supply considerable populations as, for example, the Bois Manque well in Pamplemousses serving Plaines des Papayes, Fond du Sac and Belle Vue (Harel) Estate. There is always 20 to 23 feet of water in this well and it is pumped to tanks holding 11,150 litres. Another large well is that at the Vale, Rivière du Rempart, whence it is proposed to supply the hamlet of the same name and the villages of Grand Baie, Petit Raffray and François Camp.

Wells

Large wells.

Wells are found scattered all over Mauritius and the water which they furnish, when protected from surface pollution, is, save when brackish, usually of good quality. Unfortunately very few of the wells are properly protected. The number of wells covered over and to which pumps have been affixed is small. In a few instances the well-head has been surmounted by a properly sloped cement concrete cover, and the water is drawn by pail and windlass operating through an aperture with a well-fitting lid. (Fig. 60.) Sometimes the cover is there but water has to be drawn by hand, and not infrequently there is no lid. All kinds of defects exist and some of the commonest are those affording opportunities for contamination from the dirty feet of those drawing water. (Figs. 62 and 64). Fig. 64 is specially instructive as it illustrates the state of matters obtaining in the case of many shallow wells at Curepipe during the earlier part of my visit.

Small shallow wells.

I found that, despite the fact that Curepipe had a supply of Mare-aux-Vacoas water, there still existed about 150 shallow wells. My attention was first directed to these wells when visiting a "typhoid fever" area in the Anderson Street district. There, in La Croix Street, I found a room 12 feet by 12 feet by 12 feet, which had been occupied by two adults and six children. Five cases of typhoid fever had occurred *simultaneously*, an important point, in this family. One patient had died, one child was still ill at the time of my visit. In adjoining premises there was a dhobie. The water supply was derived from a shallow well in proximity to the house. This well had a masonry coping and a cement cover in which there was an opening. Water was drawn by a pail lowered by a rope. I watched the process and noted how the splashings from the pail, after being fouled by the drawer's bare feet, found their way back into the well. I was informed, also, that any convenient receptacle was used for drawing the water. It was clear that there was here every opportunity for pollution of the well. (Fig. 64.)

Dangerous shallow wells in Curepipe.

Association of dysentery and typhoid fever cases with wells in Curepipe.

An enquiry was instituted and other wells were inspected in various parts of the town. I was informed that in most parts of Curepipe the subsoil is very porous. Cracks and fissures abound in it. The water in one well had been proved to be contaminated by drainage from a cemetery. It was common knowledge that cases of typhoid fever and dysentery occurred in districts served by some of these shallow wells. Efforts had been made to get them closed, but, so far, in vain. I requested the Sanitary Inspector to prepare a map showing the position of the wells and indicating their association with cases of the two diseases mentioned. He did so, and the map (Plan II.) which is here reproduced forms a remarkable and suggestive record. It shows clearly no less than 12 groups of wells associated with cases of dysentery, apart from individual wells similarly incriminated, while in four groups a connection with typhoid can be traced, and there are two instances of typhoid cases associated with single wells. As a result I submitted memorandum No. 136/R/50 of 20th June, recommending that all the shallow wells in Curepipe be either filled up or closed with cement.

Closure of wells.

There was a good deal of opposition, as is usually the case under such conditions, but thanks to the firmness of Government the wells were eventually closed, and there can be no doubt that, as a result, the incidence of typhoid fever and dysentery will notably diminish. In a place like Curepipe, shallow wells are always apt to be a danger, and it must be remembered that every case of typhoid fever and dysentery occurring constitutes a fresh focus of infection.

Control of wells generally.

Well supplies generally require attention. The ideal system would be to stein and cover all wells properly and affix pumps either operated by hand or by small petrol engines, care being taken that the draw pipe be carried not through the cover but through the wall of the well. Work of this magnitude cannot be done all at once, and in some places it might be better to close a number of wells and greatly enlarge and improve a few, which could serve a considerable population.

On many of the sugar estates there should be no difficulty in putting the wells into a proper state. Some of them have already paid attention to improving the water supplies to camp lines, but in many instances the conditions are far from satisfactory and call urgently for remedy. It should always be remembered that the chief source of danger is *surface*, not sub-soil, contamination.

Rainwater.

Supply at Quarantine Station, Canonniers Point.

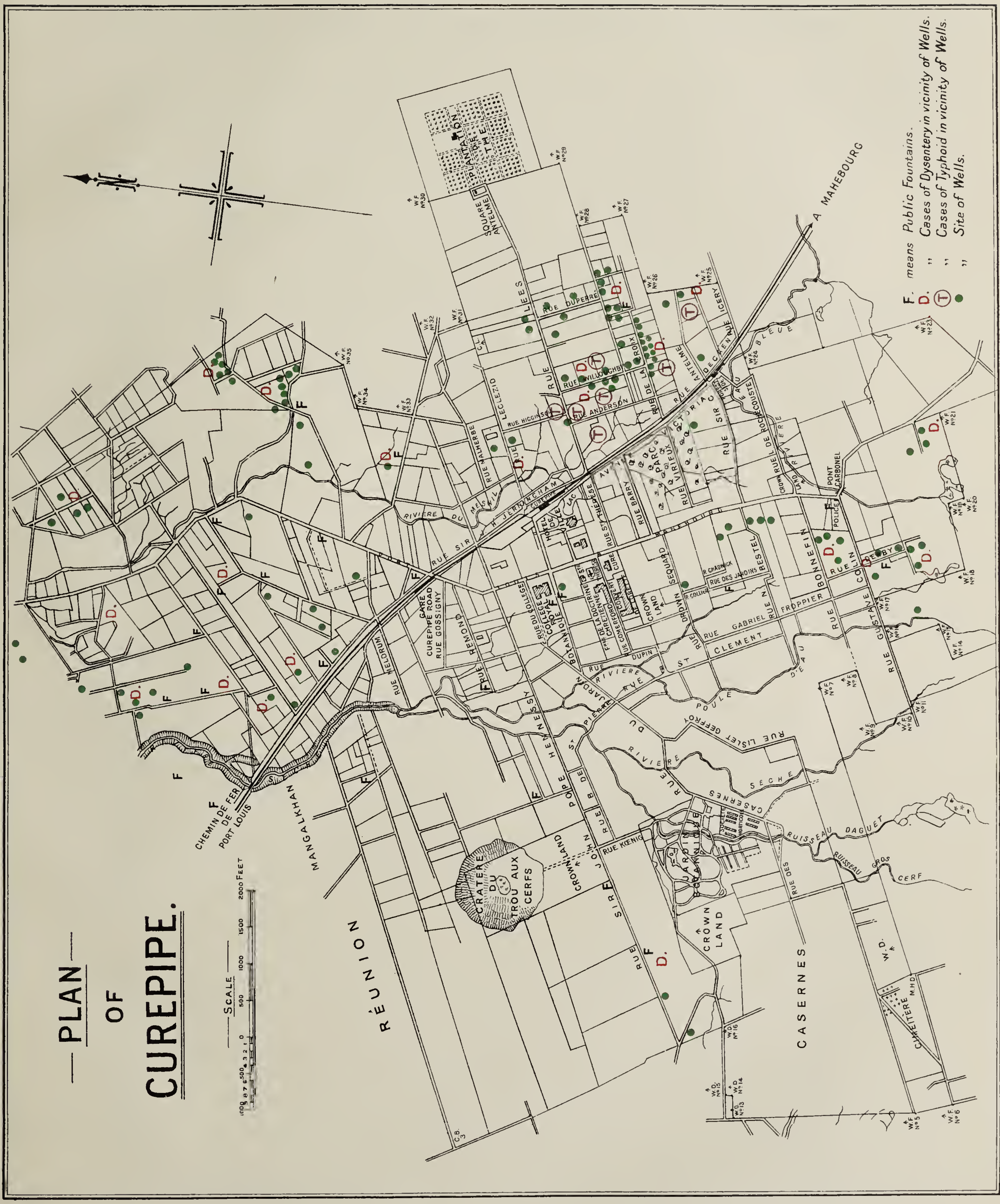
Rain water collected from the roofs of houses may be utilised for drinking purposes. The system has been elaborated at the Quarantine Station, Canonniers Point, where the water is conveyed by pipe to underground cement concrete tanks. Unfortunately there is no arrangement for rejecting the first washings, and still more unfortunately some of the tanks have no pumps, and in the case of the one which is so provided I found the pump out of order. (Fig. 63.) Hence recourse has been had to dipping and there is a risk of pollution. The matter is considered in Interim Report No. 7, p. 11.

Necessity for examination of water supplies.

It would be a very good thing if all the drinking water supplies in the Island could be examined, both chemically and bacteriologically, on the lines adopted in Egypt. This would constitute a very useful piece of research work which would be helpful to the sanitarian. It is of course quite impossible under existing conditions, but it should be kept in mind if it ever proves feasible to develop the research side of the work at the Réduit laboratory, as may be the case if outside help is forthcoming.

Mauritius is so small and compact that it would be easy enough to secure data regarding all the principal sources of supply, and thereby have a valuable record for all time.

PLAN II.



PLAN OF CUREPIPE *Showing close association of shallow wells with cases of Dysentery & Typhoid Fever.*

WATERLOW & SONS LIMITED, LONDON, DUNSTABLE & WATFORD.

COLLECTION, REMOVAL AND DISPOSAL OF EXCRETA.

Collection, removal and disposal of excreta.

Faulty conditions.

Faulty conditions in dealing with human excrement undoubtedly account for much, if not the greater part, of the morbidity in Mauritius. This is not surprising when one finds that, almost without exception, the methods employed are in every way fitted to favour the dissemination of disease. In some cases they are so bad, and indeed so disgusting and dangerous, that it is remarkable they have been tolerated for so long in a British colony. In Interim Report No. 3 I found it necessary to remind those concerned that there is such a crime as potential homicide. It may not be punishable by law, but it entails a very heavy moral responsibility, more especially when methods, admittedly unsafe, are pursued, in part at least for the sake of financial gain. It may be thought, considering how faulty conservancy systems are in many tropical countries, that this is too strong a statement, but the time has come, indeed it is long overdue, when it is the duty of the hygienist to make a plain statement of fact regarding these matters and endeavour to awaken a public conscience. I submit that the above description is in no sense an exaggeration. Hundreds of persons lose their lives in Mauritius and thousands lose their health, because the teachings of hygiene are ignored and up-to-date knowledge is not applied. Money can usually be found for all kinds of things, but few are willing to put their hands in their pockets when it comes to be a question of safeguarding health. This is a sad state of things, though happily it lacks the criminal element to which reference has been made.

Dangerous state of affairs.

Water-carriage systems.

Here and there I am glad to say satisfactory conditions exist. For example there are the excellent water-carriage systems at the Curepipe and Vacoas camps, described in Interim Report No. 3, pp. 19, 20 and 27. These, however, were installed by the military, though now the civil population benefits to a considerable degree. I may say that the percolating filter at Curepipe is of the Stoddart type, not Stafford as printed.

Septic tanks.

Water-closets and septic tanks are also in use elsewhere, as, for example, the Lunatic Asylum and the Prison, Beau Bassin; the hospitals at Moka and Candos, and in certain private schools and a good many private premises. Unfortunately, many of the tanks are of antiquated or faulty design, and, though they may function quite well for considerable periods, I fear that eventually they may get out of order. I have supplied the Public Works Department with information and plans regarding modern systems, and the suggestion has been made that the Department should prepare plans of a standard type and be in a position to help and advise those who wish to adopt the septic tank principle.

Septic tank effluents.

Even so it will be necessary to keep a watchful eye on septic tank effluents. These are often allowed to soak away underground, and while, for a time they may be quite satisfactory, they are apt eventually to become very much the reverse, especially if there is any defect in the tank or if the latter is unduly pressed. The relation of tank effluents to sources of water supply such as shallow wells also merits attention. For use amongst the poorer classes and in schools and other institutions in rural districts, I considered the suitability of what is called the Septic Privy or Wet Privy or Home Septic Tank, an ingenious American device comparatively cheap and easily installed. I decided, however, that it would be wiser not to recommend it, for, in a place like Mauritius, the water container would almost certainly become a populous mosquito nursery. It is true that this can be prevented by the addition of oil or cresol, but the precaution would rarely be taken. Further difficulty would probably arise in connection with the disposal of effluents.

At a later date, on learning that Dr. Gilchrist had been appointed Acting Director of the Medical and Health Department and was conducting a vigorous sanitary crusade, I revised the above opinion and suggested that some form of Home Septic Tank might be exceedingly useful, especially in the case of schools. I also asked Dr. Minett, who had devised a very cheap and useful form for use in British Guiana, to send plans and information regarding it to Mauritius. He has done so, and at the same time care has been taken to point out that the larvæ of ankylostomes may be found in the effluent from such a latrine, a fact which necessitates special precautions being taken.

Sewerage of Port Louis.

Part of Port Louis is sewered (see Plan III.), but unfortunately the sewerage system has not proved a success. Some of its deficiencies are noted in Interim Report No. 1, and Figs. 79 and 80, and show certain points to which reference was made in that report. The explanatory text under the photographs sufficiently explains the faulty conditions.

The whole sewerage problem in Port Louis is to be dealt with by Mr. Mansergh from the engineering standpoint, and it is much more a question for a sanitary engineer than for a medical sanitarian. There are, however, a few paragraphs from my report on Port Louis, which I feel should be here transcribed owing to the importance of the subject with which they deal. When speaking of the extension of the water-carriage system and the provision of a sufficient number of public latrines the following statement is made :—

Necessity for dumping depôts.

> " The provision of public latrines should theoretically meet the wants of the occupants of such houses, but in practice this is not the case, and it is the general experience that if dangerous nuisance is to be avoided a certain number of pail latrines has to be permitted, though that number should be reduced to an absolute minimum. I mention the matter here so that when the sewerage scheme is considered as a whole the necessity of providing a few dumping depôts should not be overlooked. These are places to which the full and covered latrine pails are brought. Their contents are emptied into the drain through a trapped closet or hopper sink and the buckets are cleaned on the spot. With an ample supply of water and deodorants and efficient supervision, this method is not productive of nuisance. A design of a dumping depôt will be found on p. 191 of Clemesha's ' Sewage Disposal in the Tropics.' "

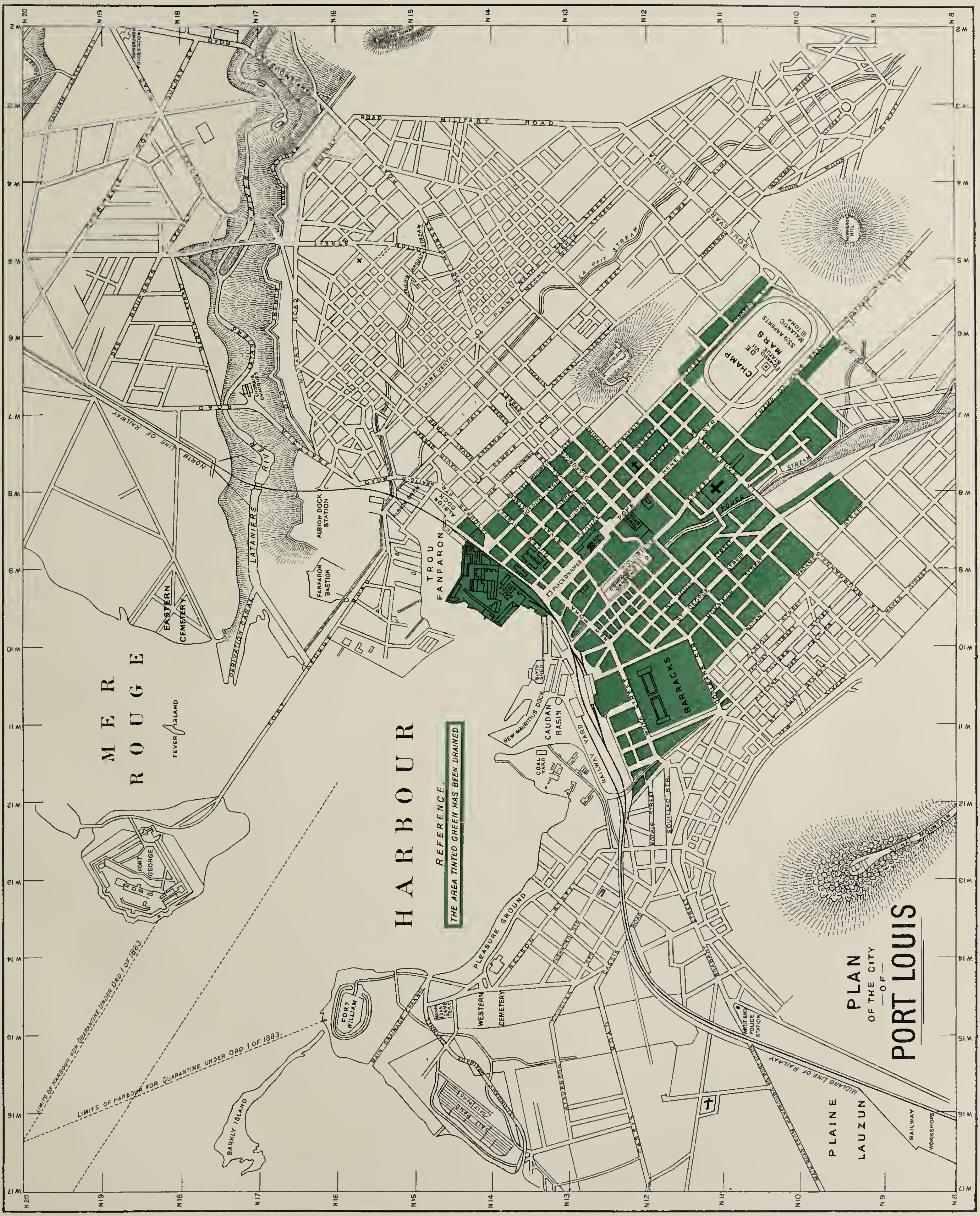
Discharge into sea.

There can be no doubt, and I know Mr. Mansergh agrees, that discharge into the sea is the only feasible method of dealing with Port Louis sewage. No fault can be found with the site of the present outfall. I was unable to find any nuisance as the result of the discharge which is in the vicinity of the old Victoria Fort.

The Caudan Basin.

Mention must be made of the Caudan Basin, which communicates with the harbour and receives the discharge from the Pouce and Tonneliers streams. These carry down a large amount of mineral detritus, which has filled up the Basin to a considerable extent, but the latter is also the recipient of sewage, for a storm overflow discharges sewage from one of the town sewers into the Tonneliers stream while the canal formed by the junction of the stream with the Pouce leads to the Caudan Basin and is also polluted in the same way. (Fig 80.) Both Canal and Basin are filthy and malodorous. Gases are evolved from the decomposing sewage and bubbles can be seen rising and bursting on the surface. I understand a scheme for dredging these places is under consideration. It is very desirable they should be purified, but it must be remembered that the dredging is intended not only to clear away the filth, but more especially to remove the detritus, and it would seem desirable that none of the General Improvement Fund should be devoted to this purpose, for, however disagreeable and offensive the state of the Canal and Caudan Basin may be, there is no evidence to show that it is *directly* inimical to health.

PLAN III.



PLAN OF PORT LOUIS. *Area coloured green has been sewered.*

WATERLOW & SONS LIMITED, LONDON, DUNSTABLE & WATFORD.

Even if pathogenic organisms find their way into the open air from the bursting bubbles, as may quite possibly be the case, it is unlikely they are absorbed by persons in the neighbourhood and productive of disease.

In all probability the worst that can be alleged against this insanitary corner of Port Louis is that it is evil-smelling, an eyesore and occasions nausea.

If there were plenty of money obtainable from the fund then it would certainly be justifiable to expend it on abolishing this disgusting nuisance, but, as will be seen, this is not the case and if the Caudan Basin has in any case to be dredged and cleaned for commercial purposes I think the work should not be regarded as a charge against the fund.

Sewerage scheme for the five towns, Plaines Wilhems.

It is intended to devote a portion of the Improvement and Development Fund to the provision of water-carriage systems for the five townships in the Curepipe-Beau Bassin area. Such a scheme, though very expensive, is highly to be commended, for, as will be seen, the conditions generally in this area leave much to be desired.

The Haworth system.

I have discussed the question briefly in Interim Report No. 3 and Mr. Mansergh will report upon it fully. In all probability systems similar to that in use at Vacoas will be found best. There can be no doubt as to the value of the new Haworth modification of the Bio-aeration system of treating sewage, but I fear, as I said, and I believe Mr. Mansergh agrees with me, that the conditions in Mauritius do not lend themselves to its adoption.* What is required there is some arrangement which is to all intents and purposes fool-proof. The Haworth system necessitates machinery and skilled supervision, and hence it seems wiser to stick to a method which has already proved its utility in the Colony, *i.e.*, that of the septic tank and percolating filter.

Discarding such a primitive method as the use of cane-fields or any convenient cover as latrines, a method which, though exceedingly common and highly dangerous, scarcely lends itself to description, it may be said that so far as collection is concerned, there are two chief " dry " systems of conservancy in general use.

The one is the pit latrine or privy, the other the pail system.

Pit latrines.

The work of Kligler.

1. *Pit Latrines* are chiefly found in Rivière du Rempart, but I came across them in Black River District and they exist elsewhere. It may be said at once that the recent work of Kligler, in South Carolina, has to some extent altered the views previously held as regards their danger, at least so far as infection of neighbouring water supplies is concerned. Indeed, he states, apparently with good reason, that pit privies, if properly constructed, *i.e.*, so designed as to exclude flies and to be safe from overflow wash, are practically free from danger as far as the spread of intestinal infections of bacterial origin is concerned. It remains to be seen whether this is also true as regards hookworm infection, but the risk of ankylostomiasis from a properly constructed pit privy cannot in any case be great, unless possibly to those who remove its contents and to those who come in contact with them if they are used in the fresh state as manure, a procedure which should not be permitted.

Dangerous organisms were found to die out rapidly in fæces and privy material, and water percolating through soil could carry them only 3 to 5 feet under ordinary conditions and not more than 10 feet in a vertical direction after heavy rain, save in limestone regions or where the subsoil contained cracks or fissures. The chief point demonstrated was that it is the *vertical* distance between the source of pollution and the ground water that is the significant factor. As a result pit privies cannot be regarded anywhere as safe in localities where the ground water level is nearer the surface than 10 to 15 feet. Otherwise a pit properly made, fly-proof and about three feet deep, can be employed with safety if the subsoil be of suitable type. Even at present, badly-constructed and ill-protected as they are, the pit latrines in Mauritius are, as a rule, infinitely better than the pail system. The reason is that there is less surface pollution and that, being at least somewhat dark, they are not very attractive to flies.

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* Confirmation of this belief is forthcoming in the Mansergh report.

Advantages of pit latrines.

In the rural districts, save in places where they are for the above reasons definitely contraindicated, there can be no doubt that they constitute the method of choice. They are cheap, not markedly offensive and easily constructed. When sufficiently full the pit can always be filled in and treated in such a way that fly breeding is discouraged. A new pit can then be dug and the superstructure, *i.e.*, the latrine building, shifted and placed over it. As a rule there is quite sufficient land available to permit this process to go on indefinitely, for, after a few months, the ground can be re-pitted. The contents should not be removed unless removal is essential owing to insufficiency of land. If they are removed the process must be carried out in a cleanly manner and the loamy material which eventually forms in an old filled-in pit may be utilised as manure after the lapse of six months. It is very necessary that the privy seat be fly-proof, and if funds permit, the latrine building should also be designed to exclude flies, though this is rather a counsel of perfection.

I would recommend—

Recommendations regarding pit latrines.

(*a*) That a survey of the rural districts be made, the character of the subsoil ascertained, the ground water levels, when at their maxima, determined, and a statement drawn up showing the localities in which pit privies of an approved pattern are permitted both for private dwellings and for schools and other institutions.

(*b*) That a plan of a simple and efficient type of latrine building, privy seat and pit be prepared and that measures be taken to ensure that only the approved type is used. The pit itself should be fashioned in such a way that flooding from the surface is prevented. It should be made a punishable offence to construct any other pattern or to use the pit in an improper manner.

The deep fosse.

In certain parts of the littoral where there is a coral formation and the limestone is impregnated with brine there is no objection to what is called the Deep Fosse, unless there is any risk of polluting wells. The deep fosse is a shaft, often bottle-shaped, sunk for a considerable depth in the coral, and it will function for long periods without any attention whatever. I have seen places in Mauritius where I believe it could be used to advantage, say in the case of schools, especially in Rivière du Rempart and Black River District.

Fuming pit or smoke latrine.

Of more importance is the Fuming Pit or Smoke Latrine (Fig. 82), which, in its most recent form, appears specially suitable for use on sugar estates. It is fully described and figured in Interim Report No. 3. Before I left Mauritius I had the opportunity of seeing the Fuming Pit which the Hon. M. D'Unienville, who took a keen interest in the matter, had constructed at St. Hubert, in Grand Port. (Fig. 84.) It appeared to be acting well and to be popular amongst the coolies, for whom lavage facilities can easily be provided. I am hopeful that it will be a success and go a long way towards diminishing the incidence of ankylostomiasis and other excretal diseases.

Concrete vault sanitary privy.

Where on account of the height of the ground water or the character of the soil the ordinary privy pit cannot be employed and when the deep fosse or the fuming pit is not suitable, the use of the Concrete Vault Sanitary Privy as described and figured in Interim Report No. 5 should be advocated. Unfortunately, it has been found that the introduction of these vaults would be rather expensive, so that their utility is limited. If neither they nor pit privies can be used, recourse must be had to the pail system, which will now be considered.

The pail system.

(2) *The Pail System.*—It is possible, though by no means easy, to run a pail system for a native population in the tropics on sound sanitary lines, but even when receptacles, seats, means of transport and method of disposal are all as good as they can be, the results will be unsatisfactory unless there is efficient inspection and control.

Generally speaking, in Mauritius none of the essentials to success are forthcoming.

Collection.

The pail in common use is a wooden tub constructed of staves bound by metal bands, in short, a kind of small barrel. It is supposed to be tarred, but, save in certain places, the evidence of tarring is non-existent. The wood gets soaked and becomes very foul. As a rule the pails have no covers and a handful of grass or cane trash is pushed down on the top of the contents as an absorbent agent and to stop splashing.

The seat is practically never fly-proof and is often a makeshift affair which is frequently in a shocking state of uncleanliness. Unfortunately this is often the case in the latrines at schools and railway stations, a fact on which both Dr. Kendrick and myself found it necessary to comment in severe terms. The latrine building is rarely satisfactory and its floor, even when of cement concrete, is often in a bad state and grossly polluted.

Improved system at Mahebourg.

Altogether what may be called the first stage of the pail system in Mauritius is, except here and there, about as bad as it can possibly be, and even long ago was deemed a fitting subject for the pencil of a clever French cartoonist. During my visit the efforts of H.E. the Governor brought about a considerable change for the better in Mahebourg. The wooden pails, unfortunately, persisted, but they were provided with lids and were properly cleaned under close supervision.

In many parts of the Island the pail system must persist and it must remain the chief method of collection in a great part of Port Louis and in the five townships in Plaines Wilhems until the sewerage schemes have been completed. How, then, can it be rendered decent and hygienic?

Recommendations regarding the pail system.

In the first place the wooden tub must vanish and be replaced by a seamless steel, galvanised metal pail of proper shape and dimensions and provided with a cover. So far as I know there is not at present an absolutely satisfactory sanitary bucket on the market, but, pending the introduction of such a receptacle, I recommended the use of pails of the type employed in Johannesburg. They are easily packed, easily cleaned, not readily damaged, are not too heavy and stand much wear and tear. I understand a supply has been ordered.

In the second place, fly-proof seats with falling lids should be provided and care should be taken that the pails fit properly under the seats. One need not here enter into details. There are certain well-known principles which must be followed and which are enunciated in various works on tropical hygiene. In the third place, though this is perhaps less important, the latrine building requires attention, especially as regards flooring.

In Port Louis there will have to be a wholesale reconstruction of house latrines if anything of value is to be accomplished, for in many places the conditions beggar description and a great deal of uphill work will also be required elsewhere. The Government should set an example in connection with schools and railway stations, and in the former there should be small sanitary demonstration centres with little models. Education in these matters is required and that education should be imparted through the eye, not through the ear or nose!

Public latrines and urinals.

The question of the provision of an adequate number of properly-constructed public latrines and urinals in all the larger towns, properly lighted at night and with attendants to keep them clean and look after them, is one of much importance. In Port Louis the public latrines are far too few in number, some of them are of a very bad type and all of them, as a rule, were found to be in a filthy condition. In Curepipe, *mirabile dictu,* there was neither a public latrine nor a public urinal. In other towns the conditions were, almost without exception, unsatisfactory. All this public service will have to be put on a proper basis and a great opportunity will be afforded in Port Louis and the Plaines Wilhems townships when the sewerage works are being carried out, as we may hope will ere long be the case.

Where pail latrines persist it is always worth while considering if the sump-pit for washings cannot be replaced by a soak-pit, for the latter saves a great deal of trouble and rarely constitutes itself a nuisance. Whether a water carriage or a pail system is in vogue it must not be forgotten that the lower-class population of Mauritius is composed of elements which have different habits as regards certain aspects of sanitation. This elementary fact is largely ignored, notably at railway stations, and is one of the causes why the latrines at these places are a byword. In certain parts of Port Louis provision does exist for those who practise lavage and reference to the subject will be found on p. 11 of my Third Interim Report.

Sawdust urinals.

Another matter worth remembering is the great utility of sawdust urinals. The installation in the Civil Prison, Beau Bassin, has been very successful and that which was introduced at the Royal College, Curepipe, promised to be equally so. In the case of the latter the clear, odourless effluent was conveyed by a pipe to a soak-pit, which answered well.

Removal.

The second stage in the pail system is that of removal. It need scarcely be said that this should take place at least once in the 24 hours. Yet in Mauritius this is the exception. Thrice weekly removals are the rule and so the pail contents frequently overflow, the excreta decompose and it is common to find fly-maggots in the pails. The conditions are usually both disgusting and dangerous, and I found places where even the supposed removal three times a week did not take place. The work was neglected and sometimes this neglect took the form of a non-replacement of the receptacle, with the result that ordure was deposited on the floor and had been so deposited for some considerable time. I have cited a case, and it is by no means exceptional, where a fowl was found busy feeding on fly larvæ in the pail and another instance where there was no tub and the aperture in the latrine seat was occupied by a basket intended for a sitting hen! The latrine, indeed, had been turned into a fowl-house and the dwelling, situated in the main street of a town, had no sanitary convenience whatever.

Dirt and danger.

The removal itself is usually accomplished by ox-drawn, wooden, covered carts of rather a special type which possess sliding doors. (Fig. 69.) When the latter are closed the interior is dark and accordingly not very attractive to flies. At the same time when the carts are open flies gain access to the uncovered pails and cohorts of the insects in hot weather accompany the carts on their rounds and voice their satisfaction in no uncertain manner. Ox-transport is slow and it is very necessary that, wherever possible, motor vehicles of a suitable pattern and constructed of metal should be employed. In many places the number of carts is quite inadequate. The removal is for the most part in the hands of contractors and, as might be expected is, as a rule, very badly performed. All these matters have been dealt with in the interim sanitary reports and must engage the attention of the new Director of the Medical and Health Department at an early period.

Introduction of motor vehicles.

When District Medical Officers of Health are appointed (see p. 122 and Graph B.) it will probably be found best to make them responsible for the conservancy work and to do away with contractors altogether. The decision however, must be made locally, for conditions vary in different places. In small villages the existing carts may serve the purpose if there are proper sanitary pails and if enough of the carts are forthcoming. The Sanitary

Inspectors and Guards would look after the running of the system and thereby do something really useful and take a pride in seeing the service was efficient.

Disposal.

The third stage of the pail system, and the one chiefly associated with nuisance and danger, is that of disposal. Here we find ourselves face to face with conditions which are quite peculiar and which probably have not their parallel in any other part of the world. The main industry in Mauritius is sugar cane cultivation. The cane requires fertiliser and as Victor Hugo said, possibly with some truth, " the most fertilising and effective of manures is human manure." Unfortunately in the tropics it is also the most dangerous. This fact was not recognised. All seemed easy and simple. The town and village communities had a product of which they were anxious and rightly anxious to be rid. The planters were only too glad to obtain for nothing or next to nothing a commodity on which their canes throve exceedingly.

Use of human excreta as manure.

The Engrais system.

The Engrais system came into force and, to put it plainly, has been one of the curses of Mauritius. It is true that it is better than nothing, it is true that a well constructed and well managed Engrais has some virtues to commend it, it is true that in some cases Engrais appear to have been established, mistakenly perhaps but none the less genuinely, with a view to helping the public in some measure and putting an end to methods of primitive barbarism, but it is also true that many Engrais are most disgusting and dangerous places and that the habit of spreading their contents, after a more or less lengthy " ripening " process, broadcast on the fields is responsible for much of the ill-health in the Island, and is also the reason why flies and especially Stomoxinæ abound.

Dangers of the Engrais.

The Engrais (Figs. 70-76 and 78) is really a modification of the old Nassik system of India or the still older method employed for countless generations in China, that land of worms and filth diseases. Where those who manage Engrais do their best and look after them they can scarcely be blamed for the faultiness of the system but where, as at the scandalous Roche Bois Manure Factory, which serves a large part of Port Louis, every canon of hygiene is ignored, words cannot be found strong enough to condemn those who profit by an undertaking which is a menace to the health and well-being of the inhabitants.

The Roche Bois manure factory, Port Louis.

At this delectable spot piles of street refuse are accumulated for admixture with the pail contents in open tanks. The walls of the latter are ruinous so that pigs and fowls gain access to the liquid filth, become befouled and then wander about, an attraction to flies, a spectacle calculated to excite emesis.

The method followed is to throw some rubbish or cane trash on the floor of the pit, then to pour in the pail contents. Another layer of refuse is added, than another dose of excrement, and so on till the tank is full. The stinking mass is then left to " ripen " but is frequently carted away after the lapse of three weeks and applied to the surface of the soil. Not infrequently the bed of rubbish or cane trash is omitted. I have seen the floor of the tank covered with a layer of liquid filth in which pigs were wading and which emitted a stench sufficient to turn the strongest stomach. (Figs. 71 and 72.) Yet the Manager denies that anything is wrong and appears to regard himself as a public benefactor! (1)

Conservancy of government institutions in Port Louis.

Unfortunately there is a contract which makes it difficult for Government to free itself from its obligations, especially as at present it is not in a position to carry out the work itself.

It is true that the Medical and Health Department is responsible for the conservancy of Government institutions in the unsewered portions of Port Louis and removes pails from these places to a small trenching ground near Fort Victoria. The transport and disposal are carried out in a satisfactory manner but in some cases the removal is only conducted thrice a week. A recommendation was made that, as soon as possible, the Department should obtain all the equipment necessary for taking over the whole of the dry system in Port Louis and that the Roche Bois Manure Factory and also a small subsidiary Engrais in Pamplemousses, serving some of the eastern suburbs, should be suppressed.

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(1) In this connection see also the remarks by Mr. E. L. Mansergh on page 75 of his Report.

Until the sewerage system for the whole town is completed it will probably be best to have recourse to a proper trenching system or to establish a dumping tank close to the coast, the effluent from which can be run into the sea at a place where no nuisance is likely to result.

Temporary measures for the five townships, Plaines Wilhems.

Smoke Engrais.

The question of the rural districts.

The midden heap.

In the case of the five townships in Plaines Wilhems the provision of trenching grounds, with of course facilities for pail cleaning, as a temporary measure seems advisable though it may be possible to convert some of the existing closed engrais into smoke engrais as suggested in Interim Report No. 4, p. 11. The smoke method, if properly managed, would prevent fly-breeding and the contents of the engrais could be removed and buried or, if sufficiently dry, burned but on no account used as manure. This idea of smoke engrais might be developed in the rural districts. There is nearly always an engrais in some convenient place. It is frequently of the open type and nothing but a fly nursery, but well constructed closed engrais exist even on some of the sugar estates. On others again the engrais is represented merely by a large midden heap in the open. (Fig. 73.) A hole is made in the top of the mass and the pail contents are buried. If they were undisturbed it is possible that the heat of the manure might prevent fly-breeding operations, but what one usually finds is that fowls scratch upon the heap for a living and expose the buried excreta. Ducks, geese and pigs also have access to it. Further in heavy rain, the mass gets soaked and there is a very foul drainage from its which may find its way into water-courses. I have seen bare-footed Indian children coming and going on the surface of one of these heaps which they were watering with evil-smelling drainage effluents and syrups.

There can be no doubt the open engrais must wholly disappear and that even the closed variety can only be permitted under the conditions indicated. At the time of my visit it was known that the engrais bred out flies in thousands, but there was no evidence to show how long pathogenic bacteria, the entamoebae of dysentery or the larvæ of ankylostomes could persist in them.

Work of Stiles.

Light has been thrown on this problem by the recent work of Stiles, who, as stated in Interim Report No. 3, p. 34, has shown that under conditions such as obtain in engrais *Entamoeba histolytica* can survive for 52 days, and ankylostome larvæ in all probability for a year. Hence it is imperative that the contents of engrais, even if treated by the smoke method, should not be used for the purpose of manuring canefields.

Recent work on anklostomiasis in Trinidad.

The majority of the planters have stated that this type of manure is not essential, and that they will gladly dispense with it, if thereby ankylostomiasis will be diminished and the efficiency of their labourers increased. This can safely be promised. Moreover it would appear from the recent work of Cort, Augustine and Payne, based upon observations made in Trinidad that, if repeated pollution of soil over a wide area with ankylostome material is prevented, the outlook is more hopeful than it has hitherto been regarded.

The above investigations have shown that, under *ordinary* conditions of soil pollution in a canefield, there is no *active* migration of hookworm larvæ. They remain definitely limited to the place where they have developed. Furthermore it has been proved that they almost completely die out within six weeks, and that an area even of very heavy soil infestation will soon become safe after the elimination of soil pollution.

Report of Dysentery Committee (1920).

The Dysentery Committee (1920) expressed itself in favour of incineration of excreta. The method is a valuable one, but it must be remembered that it requires very careful supervision for incineration, badly conducted, may give rise to serious nuisance. Here and there it may be found serviceable, but I doubt if, in Mauritius, it could ever be managed on proper lines, and therefore I would prefer to see the smoke engrais or trenching adopted.

Trenching ground, Mahebourg.

An example of what can be done in the way of trenching is to be seen at Mahebourg where, at the instigation of the Governor, a trenching ground was laid out and excellent arrangements made for cleaning tubs and pitting their contents. In certain respects there were defects which, however, can be remedied on the lines mentioned in my 259/R/125 of September 21st, 1921.

Trenching grounds require much attention and cost a good deal, and it was with a view to economy as well as efficiency that the idea of the smoke engrais was put forward. It is frankly experimental but merits a fair trial.

When the sanitary services throughout the Island are properly organised it should be possible, at least in all important centres of population, to revolutionise completely, on the lines indicated, the present exceedingly faulty methods of conservancy. If this is accomplished there can be no doubt whatever that a remarkable change will ere long be witnessed in the incidence of those filth diseases, which at present are rampant, and which not only help to fill the cemeteries, but cripple labour and cause much suffering and sorrow.

Necessity for education.

Above all things, however, it must be remembered that in this part of the campaign education is essential, and that firm action must be taken in the case of those who for their own ends may oppose sanitary progress. A great responsibility rests on the shoulders of employers of labour, and every effort should be made to obtain their co-operation, which perhaps can best be done by proving to them that it is in their own interests to support measures which cannot fail to increase the efficiency of those who serve them.

COLLECTION, REMOVAL AND DISPOSAL OF REFUSE.

Collection, removal and disposal of refuse.

Conditions in Port Louis.

Here again Mauritius is far behind the times. In the towns, until recently, dust-bins were conspicuous by their absence. Port Louis was in a disgraceful state. The yards were for the most part filthy and the streets littered with garbage. Indeed at night the conditions were mediæval and one traversed ill-lit, badly paved thoroughfares, stumbling over refuse heaps and splashing into channels of foul sullage water.

It was difficult to believe that such things could exist in the capital of a British Colony.

It must be remembered that the said capital is now peopled almost entirely by Indians, Creoles and Chinese, and that few persons of European origin, at least during the greater part of the year, ever spend a night in it.

Yet it is beautifully situated and must once have been for eight months of the year a pleasant place of residence.

It is a case of Paradise Lost, and it remains to be seen if the sequel, Paradise Regained, will ever become an accomplished fact.

Failure of scavenging service.

The scavenging work was under the control of the Municipality, and the failure to carry it out properly was due apparently in part to the lack of recognition of what really constitutes a clean town, in part to the absence of a trained sanitary staff, and in part to a deficiency of carts and transport animals. Many of the last named had died of surra, and they had not been replaced while the remainder were in very bad condition.

Apart from anything else the dirty condition of Port Louis (see Figs. 85-87) afforded ample pabulum for rats, while no doubt it accounted in some measure for the prevalence of sore throats. At an early date I pressed, as the Governor had already done, for the provision of dust-bins, and the Mayor took up the matter and eventually had useful types manufactured.

Dr. Gilchrist's work.

One of Dr. Gilchrist's first tasks was to clean up the town, an undertaking he embarked upon with characteristic energy. Two motor ambulances, which had been found not sufficiently high-powered for the hilly roads and were little used, were quickly converted into refuse lorries. Mr. Purvis, a newly appointed qualified British Sanitary Inspector, was put in charge of the work; Dr. Gilchrist transmitted some of his own enthusiasm to certain of the local Sanitary Inspectors and the campaign against dirt was started. (Figs. 88, 90.) Despite protests from the Manager of the Roche Bois Manure Factory, the accumulated filth of years was gathered together at a convenient dumping ground and burned. (Fig. 90.)

Filthy state of yards.

Few people had any conception of the real state of the yards. It was known they were dirty, but one was scarcely prepared for the piles of refuse of all kinds, ranging from Chinese skulls to broken metal, which were swept out of them. Supported by the Government and aided also by the Mayor, Dr. Gilchrist soon brought about a radical change. I only saw the beginning of the cleansing of this Augean stable, but, even so, the place began to wear a different look, and I understand that Port Louis now hardly knows itself. Naturally there was criticism and opposition—there nearly always is on such occasions, but Dr. Gilchrist did his duty unperturbed, and was able to pay a tribute to some of his Mauritian assistants, who ably seconded his efforts.

Provision of dust-bins.

At an earlier period steps were taken with a view to getting a few large dust-bins constructed for street use and a good type of small dust-bin for domestic refuse adopted, a matter in which H.E. the Governor took much interest. It is not an easy matter to arrange, for almost anything of any value is stolen, as usually happens in the tropics, but it is hoped that an efficient system of collection will be evolved.

Incinerators.

At a later date two small Horsfall B incinerators were secured, one from the Military, one from the Agricultural Department, and these were brought into use, but, as stated in my first interim report, it is necessary to furnish Port Louis with a large destructor, say of the Horsfall type, which will not only cope with all the refuse, but from which there will be a certain return in the way of useful clinker, paving stones, etc.

Need for a destructor.

Measures similar to those adopted in Port Louis, though on a smaller scale, must be applied in the other towns.

At the Governor's model village, Cassis, a small incinerator of the Morris type, somewhat modified, was installed and found to function well. (Fig. 89.) Here, also, dust-bins were provided.

Thanks to Mr. Pitot, Secretary of the Beau Bassin - Rose Hill Board, refuse receptacles of a good type were provided in the markets of both towns, but everywhere there is need of cleaning-up, though some places are much better than others. At present most of the refuse goes to the engrais, but this must cease and incineration take its place as the method of the future, unless non-offensive refuse is required for filling up hollows and obliterating swamps. Refuse carts should, if possible, be covered. If the cost is prohibitive, rope-netting should be employed to prevent their contents being blown out of them by the violent winds which are rather a feature of Mauritius.

Suggestions as regards Indian locations and camps.

In the case of small villages, and Indian locations and camps, it would not be a bad plan to offer a prize for the place that is kept in the cleanest state. If only a healthy rivalry can be excited a good deal may be accomplished.

Beau Vallon sugar estate.

Stringent action is required, and I am glad to hear has been taken in connection with some of the sugar estates camps, notably Beau Vallon, a most insanitary spot where hundreds of pigs roam at will, no doubt acting as scavengers but fouling the ground in every direction and constituting an intolerable nuisance.

THE DISPOSAL OF SULLAGE WATER.

Disposal of sullage water.

This is always one of the most difficult problems in the case of communities living under tropical conditions, and in Mauritius, owing to the ample supply of water, it is a question of great importance.

Conditions at military camps.

It has been solved and well solved in the case of the Military Camps at Vacoas and Curepipe by the introduction of cement concrete channels leading to large covered soak pits. (Fig. 93). The soil in these localities happens to be very porous and the system functions splendidly.

Pollution of gutters and surface drains.

Here, however, there was abundance of technical skill, plenty of labour and ample funds. Perhaps the most creditable work on similar lines is at the Civil Hospital, Moka, and other good examples are not lacking. It is rather when we look at the individual house in the town or village that we are confronted with the difficulty of knowing what to do. Where there is a sewerage system there is little or no trouble, but in the absence of proper drainage the effluents from sinks, baths, and it may be cowsheds and stables, together with the washings from floors and more especially foul water from latrines pass into surface gutters or earthen channels. In Port Louis much of this liquid filth finds its way into the streams which traverse the town, and the beds of which have, as a rule, been excellently canalized. (Figs. 27, 29, 30.) In the dry season the channel beds become foul and decomposition may occur with the emission of disagreeable smells. Street gutters get blocked or damaged (Fig. 13.), and pools form in which mosquitoes breed. Anopheline larvæ are happily not found in waters containing soap.

Storm waters and trade effluents.

The question of the necessity of dealing with storm waters plus sewerage, separately, is an engineering one. It may be possible to deal with some of the less offensive trade effluents, such as washings from garage floors, aerated water factories, etc., on the same lines as storm waters, but this question cannot be here considered to any advantage. Anything which smells or is liable to decompose should be conveyed underground.

Field's flushing tanks.

It is perhaps in a place like Curepipe with its earthen side drains that there is most nuisance but one is inclined to think that the danger has in the past been somewhat exaggerated. The cost of cement-concreting miles of earthen drains is very heavy and when the mosquito breeding question does not come into the picture such a radical measure is, I believe, unnecessary if care be taken to intercept really dangerous and offensive effluents by means of soak pits fitted with grease traps and to place flushing tanks of the Field pattern at the heads of the street drains.

Value of the absorption pits.

The value of the soak pit, so familiar in camp life during the war, has not been sufficiently recognised in Mauritius. Moreover, it has been rather discredited owing to the fact that, in many cases, the pits have been badly constructed and, not being fitted with simple filters, *i.e.*, petrol cans filled with grass or sand, have soon become clogged, and have failed to act properly.

Now that a satisfactory type has been introduced I am hopeful that a good deal of the trouble connected with sullage water will disappear, more especially if Sanitary Inspectors are trained in their use and abuse and are in a position to advise regarding them. In some places a system of surface irrigation can be carried out but this is more suitable for rural districts where there is plenty of land, and in any case it requires supervision to prevent mosquito-breeding.

Special effluents.

Mention must be made of some special effluents. Those from two rum distilleries discharge into the sea, which they discolour and where they kill fish, but no better method can be devised for getting rid of them, and no great harm is done.

Slaughter houses.

The blood and floor washings, consisting largely of manure, from the slaughter houses are a source of trouble and nuisance. At Port Louis they are conveyed by a cement concrete channel which is apt to get blocked (Fig. 91) to an open pit provided with a series of perforated metal baffle plates. (Fig. 92). The solids precipitate, the liquid portion is run off and finds its way into the shallow marine basin known as the Mer Rouge.

The tank is very offensive and breeds flies.

I have suggested that the manure be stacked and fly-breeding prevented by covering the mass with oiled earth, one measure of heavy oil to 40 measures of dry earth or sand, and have indicated how the process is best carried out.

The liquids may be dealt with by means of a septic tank and absorption pit or might perhaps be purified by the addition of lime instead of being conveyed to a septic tank which does not always deal well with this class of effluent. In the case of other slaughter houses where the nuisance is not so great similar measures may be employed, unless it is preferred to treat manure and offal by storage in fly-proof buildings as at Mahebourg, quite a good idea if properly carried out, (*vide infra*).

Liquid wastes from sugar factories.

A matter of great importance is the disposal of the liquid wastes from sugar factories. Cane-crushing had commenced some little time before my visit terminated and I had an opportunity of seeing the character of the effluents and the means adopted for their disposal. There are two classes, which in Natal are known respectively as (I) Dunder, (II) Condenser Waters.

Dunder.

(I) Dunder, which is of a semi-liquid character consists of scum, residue, refuse, washings and other dirty waters. These contain sugary matter, compounds of sulphur, certain acids and a small percentage of vegetable wax and, being liable to fermentation, may be productive of great nuisance. The discharge of this water into streams is prohibited by law, but it has taken place, and Dr. E. Laurent informs me that at Vacoas it was shown to be the cause of dysenteric diarrhoea in the case of villagers who had drunk the waters of a stream polluted with this class of effluent. In any case it discolours river water, kills fish, and offends both the eye and the nose.

It is difficult to know what to do with this residue. In Natal it is pumped out on waste sandy land or led to shallow sand pits and allowed to percolate through 10 feet of river sand. Dr. Park Ross, who kindly furnished me with information on this matter, states that the seepage water does not damage vegetation, though it may impart a slight taste to the river water. The remaining sludge is carted away for manure or treated by the benzine process for the extraction of wax.

In Mauritius there are few sandy areas near sugar estates where the process could be carried on.

Probably the best method to employ is surface irrigation with channels arranged on the herring-bone principle, the sludge being used as manure.

In some parts vertical drainage might be tried on the lines of the large soak pits in the military camp, Vacoas, though I fear that eventually there might be danger of clogging. Still the lava sub-soil is very porous and provided there was no danger of fouling well-water the method might be given a trial.

Condenser waters.

(II) In Natal the condensed water from vacuum pans, triple effects and boilers may become a nuisance in factories where shortage of supply leads to the same waters being used over and over again after being cooled. Such water becomes very acid and cannot be admitted to streams. In Mauritius this does not appear to occur. Such condensed waters as I have seen were being used for irrigation purposes and were not productive of nuisance, though some of them contained a certain amount of suspended matter.

As one has here what may be called " extra " irrigation it is necessary to be on the outlook for potential mosquito nurseries.

PREPARATION, TRANSPORT, SALE AND STORAGE OF FOOD AND DRINK.

Food and drink.

In a country like Mauritius where the conditions for part of the year are tropical, where flies are numerous, where typhoid and dysentery carriers abound, where, in the towns, there is much infected dust and where tuberculosis is common, too much care cannot be taken in connection with food supplies, while after what has been said regarding drinking water it is clear that aerated waters and other " soft " drinks, as the Americans would call them, require to be safeguarded from specific infection.

It is impossible to enter fully into this question to which, in any case, a good many references will be found in the interim reports, but, taking first the meat supply, which, so far as beef is concerned, is practically all imported on the hoof from Madagascar, attention may be directed to

SLAUGHTER HOUSES.

Slaughter houses.

Both public and private abattoirs exist. Most of the latter operate on a small scale and do not appear to be productive of much nuisance, but, in the case of the larger towns, they should not be permitted.

Curepipe.

Thus the very primitive and wholly unsuitable private abattoir at Curepipe (Fig. 94) should certainly be abolished and a new public slaughter house erected in a suitable position. (See Interim Report No. 3, p. 24).

Port Louis.

The Municipal Slaughter House, Port Louis, formed the subject of several Memoranda. Though built a good many years ago, the main building is not unsuitable and is well constructed, but it is inadequate in several respects and does not fulfil the requirements of a modern abattoir. There are no proper lairs for animals, there is no room for storing condemned meat, there is no manure dump, no efficient boiler house, no destructor and no special place for the slaughter of diseased animals.

The water supply is impure, there is no proper lavatory accommodation, and the latrine arrangements are very defective. The method of marking the meat is archaic and a proper stamping machine is required.

In addition to all these defects the veterinary inspection was by no means satisfactory, and the slaughtering was not carried out on humane lines.

Moreover, the surroundings were very insanitary and, as will be seen from Fig. 91, the carts for the transport of meat to the market were strange, old-fashioned vehicles, not fly-proof, and possessing no facilities for hanging meat during transit. (Fig. 96).

I understand some of the faulty conditions have been remedied; indeed as soon as attention was drawn to the matter, action was taken in the way of cleaning up the premises generally and the Medical Officer of Health, Port Louis, will now be able to advise as to what is required in the way of new construction and improvements. I attach some useful notes he drew up on the subject of Private and Public Slaughter Houses.

" SLAUGHTER HOUSES.

OBJECTION TO PRIVATE SLAUGHTER HOUSES.

Notes on slaughter houses.

1. Difficult to keep their sanitary condition satisfactory.
2. Difficult to conduct meat inspection, and so tuberculous and unwholesome meat may be sold, therefore regulation required that slaughtering should only take place :—
    - (i) On certain days.
    - (ii) At certain hours.
3. Nuisances often arise from private Slaughter Houses on account of proximity to dwelling houses by reason of :—
    - (1) Keeping of animals prior to slaughter.
    - (2) Operations of slaughter.
    - (3) Offensive smells from refuse and garbage.
    - (4) Bellowing of cattle and squealing of pigs.
    - (5) Sanitary defects.
4. Supervision very difficult, so require special Bye-Laws. If private Slaughter Houses allowed, pay special attention to :—
    - (1) Flooring.
    - (2) Inside walls to be smooth.
    - (3) Good light.
    - (4) Ventilation.
    - (5) Adequate manure storage.
    - (6) Sound drainage.
    - (7) Efficient water supply.

Floor.—Impervious and sloping towards gully trap situated outside booth.

Drainage.—If no drainage system, a liquid sewage must be led to properly constructed cesspool.

Manure Pit.—Must have impervious bottom and be slightly raised above level of surrounding ground, and *sides* of manure pit must also be impervious and have gully trap outside pit itself to carry away liquids oozing from manure or garbage, and this gully must be connected with drain or cesspool.

Metal barrows are best for conveying filth, blood from booth to manure pit.

Blood if to be sold should be stored in properly constructed barrels with covers.

Lairs.—Accommodation for animals brought for slaughter. These lairs to be screened off from Slaughter House and to have water and food provided. Lairs should be (1) ventilated; (2) well lighted, and (3) have impervious floors.

Pounds or pends.—Places where animals are kept immediately before slaughter.

PUBLIC SLAUGHTER HOUSES.

(1) *Situation.*—Away from human habitation. Site to admit of free ventilation by direct communication with external air.

(2) *Drainage.*—On two sides of Slaughter House at least.

(3) *Water Supply* and provision for complete periodic flushing of sewer and drains.

(4) Commodious triperies.

(5) House for sick animals.

(6) Hanging room for inspecting carcases.

(7) " Condemned " cell for condemned carcases.

(8) Metal carts instead of manure pit.

(9) Steam-jacketed Digestor.

(10) Lairs for cattle to be screened off from Slaughter House with impervious floor, well ventilated and drained. Animals to be supplied with water and food.

(11) Slaughter House should not in any part be below surface of adjoining ground.

(12) No room or loft to be constructed over Slaughter House.

(13) Slaughter House to be paved with ashphalte or cement and laid with proper slopes and channel towards a gulley, which should be properly trapped and covered with a grating, the bars of which should not be more than $\frac{3}{8}$ inch apart.

(14) No W.C., privy or cesspool should be constructed within the Slaughter House.

(15) No dog, cat or fowl to be kept or allowed within the precincts of the Slaughter House.

(16) Receptacles of non-absorbent material for the collection of offal, etc., must be provided and kept clean if not in actual use, and it shall be the duty of the owner, etc., to see that they are emptied at least once in 24 hours.

(17) Free access to every part of the premises must be given to Medical Officer of Health, the Sanitary Inspectors, the Surveyor, or any Committee specially appointed by the Sanitary Authority for the purpose of inspecting the premises."

Mahebourg.

A very good and clean little slaughter house of a primitive type exists at Mahebourg and here an interesting method was in force for the disposal of offal and manure. They were thrown into buildings, shown in Fig. 95, which are partly underground and are practically fly-proof. There they are left until they resolve and become harmless, and are finally removed and used as manure. So far as I could see the system was not objectionable, nor should it be, if properly conducted, and if the buildings are kept in good repair.

Notes on other abattoirs will be found in the interim sanitary reports. The chief thing to ensure is that the disposal of blood and of manure is satisfactory. The former can often be got rid of by running it into deep fly-proof pits, provided the sub-soil is suitable.

Transport of meat.

Meat should always be covered during transport. If nothing better can be managed it should be wrapped in clean cloths soaked in salt solution. It may be noted that there are no longer facilities for cold storage in Port Louis.

MEAT MARKETS.

Meat markets

Central market, Port Louis.

In Port Louis there is a separate central market for the sale of meat, fowls and fish. It was until recently under the Municipality, and at the time of my visit was in a shocking condition. It was ill-kept and dirty, dogs had free access to it, rats were numerous, and flies swarmed upon the meat. (Fig. 98).

A latrine in a filthy condition (Fig. 77) was close to one of the meat stalls, the drainage was defective and altogether it was the worst meat market I have ever seen. This was the more to be regretted inasmuch as the buildings themselves, though only open sheds, were not unsuitable, and there is testimony to the fact that in former times Port Louis was noted for the cleanliness and excellence of its markets.

Thus Flemyng (1862), already quoted, speaks of the central market as large, well arranged and well regulated. Under municipal control and regulations it was always clean, well ventilated and beautifully supplied. He states that the prettiest quarter is the fish market where there are tanks in which live fish are kept.

Pike (1873) remarks that the bazaar is well regulated and under the supervision of inspectors who examine everything before it is allowed to be offered for sale, and any article not perfectly fresh is at once condemned and confiscated.

Truly the markets have fallen from their high estate.

Recommendations were immediately made regarding improvements but by the time I left nothing very radical, save as regards the latrine, had been accomplished though the Mayor turned on the fire brigade with its hoses, and the floor and tables received at least one thorough cleansing. (Fig. 97).

Recommendations.

The measures necessary were as here detailed. Some of them had already been put in hand by His Worship the Mayor.

(1) Provision of new zinc-lined benches.

(2) Woodwork to be oil painted.

(3) Ironwork to be oil painted.

(4) Walls to be periodically lime washed.

(5) Meat sections to be surrounded by a stout, wooden, oil-painted palisade to prevent persons having access to the tables.

(6) Each butcher to have a separate stall and chopping block.

(7) Each stall to be furnished with a framework and hooks for hanging meat, and to contain a metal refuse bin for fragments of bone, etc. Tripe to be kept under water in a separate section.

(8) Meat not to be laid on cloths, but large masses may be wrapped in clean cloths soaked in salt solution.

(9) The market floor to be repaired.

(10) Fowls to be kept in crates or cages of an approved type which can be easily cleaned. The latter to be set on a cement concrete platform and facilities to be provided for supplying the birds with water.

(11) Fish to be placed only on the excellent slate benches already provided.

(12) Large covered refuse bins for general use to be supplied.

(13) Latrine and urinal to be removed from close proximity to meat section and new structures to be erected at a place indicated. (This was completed).

(14) Arrangements to be made for the systematic trapping and destruction of flies. (This was done).

(15) Water taps with screw nozzles to which hose pipes can be attached to be installed so that the market can be thoroughly cleansed as often as may be necessary.

In addition Dr. Gilchrist made the useful suggestion that the dust from the adjoining streets could to some extent be kept out by lining the railings, shown in Fig. 98, with sheets of corrugated iron or galvanised zinc.

I hope that by this time the Central Meat Market has been put in a condition more befitting the capital of a British Colony.

The smaller meat market at Plaine Verte required attention especially with reference to the provision of refuse bins, the exclusion of dogs, the destruction of flies and the proper covering of the tables.

The sanitary control of the Port Louis markets has now been placed under the Medical Officer of Health.

The meat and fish markets at Beau Bassin and Rose Hill were better, but capable of being improved. At Curepipe the meat stalls were situated in the excellent large covered market (Fig. 99), which is a credit to the town, and which owes its existence in large measure to Dr. Edwards, C.M.G. All that was here required was the provision of railings to prevent prospective purchasers handling the meat or coming into close contact with it. Railings had been erected prior to my departure, but were not quite in accordance with the idea submitted.

Markets at Beau Bassin and Rose Hill.

Curepipe market.

In some places good market buildings, as at Mahebourg and Pamplemousses, are now scarcely used for the sale of meat, which is a pity.

The butchers' shops in Port Louis and the smaller towns and villages are, as a rule, better than might be expected. They are rather primitive places, but have been designed, as a rule, on fairly sound sanitary lines. Some of them are quite good and deserve the favourable mention which has been accorded them in the interim sanitary reports.

Butchers' shops.

Beef in Mauritius is, as a rule, of good quality, mutton and pork are procurable, and the fowls are very different to the usual stringy product of the tropics.

Indeed, speaking generally, it may be said that there are few places in the tropics which can equal Mauritius in the way of food. What with good meat, good bread, excellent sea fish and fowls, and, save perhaps as regards potatoes, a good variety of fine vegetables, together with plenty of fruit and a sufficiency of luxuries, the better class population does very well, and visitors are surprised at the abundance and quality of the provisions. It is important to note, however, that owing to the high price which sugar commanded during the war, there was a great tendency to abandon the cultivation of vegetables and put the land under cane. This led to a shortage of vegetables which, however, I think will only be temporary. It is interesting to find that exactly the same state of matters occurred in Porto Rico, as recorded by Ashford. There, however, it appears to have been followed by more serious conditions than has been the case in Mauritius. In some of the markets the arrangements for the sale of fruit and vegetables are fairly good, but in others this is not the case, and in certain places, as for example Vacoas and Quatre Bornes, there are no market buildings and the products are exposed for sale on mats, cloths or sacks placed on the ground. In this position they are apt to get covered with dust. Attention was drawn to the necessity of improving the conditions of sale.

Excellence of food in Mauritius.

BAKE HOUSES.

The fact that many of these places were unsatisfactory and that no sanitary regulations existed regarding them had led the Medical and Health Department to consider the advisability of introducing regulations on the lines of those in force in Trinidad, B.W.I.

Bake houses.

I pointed out, however, that a better guide was to be found in the Model Conditions drawn up by the Egyptian Public Health Department, copies of which were obtained for use in Mauritius.

A point not mentioned in the Model Conditions, but which requires attention, is the necessity for putting an end to a practice in vogue in some of the bake houses in Port Louis, namely the preparation of what is called "chapelure" by grinding up old dust-covered bread which is then spread on the baking boards. Bran only should be used for this purpose. Some of the lower-class bakers are in the habit of selling stale and musty bread. This should be absolutely prohibited.

RESTAURANTS AND EATING HOUSES.

Restaurants and Eating Houses.

The importance of seeing that such places are conducted on sound sanitary lines was strongly emphasized in Cairo and Alexandria during the war. It was found equally necessary to draw attention to the matter in Mauritius, and more especially in Port Louis. All kinds of defects were found, and they were not limited to the poorer type of establishments.

It is largely a question of efficient inspection and in the past this has not been forthcoming. Qualified Sanitary Inspectors are required who know what is needed, and are energetic and entirely trustworthy.

MILK SUPPLY.

Milk Supply.

In discussing this matter one is up against what is perhaps the most difficult problem in the Colony, at least so far as remedial measures are concerned. In my experience this is invariably the case in tropical countries.

Bovine tuberculosis.

In Mauritius cow's milk is almost universally used and, so far as composition is concerned, there is no fault to be found with it as it comes from the cow though, of course, it varies according to the feeding and is also somewhat influenced by other factors. Tuberculosis occurs amongst milch cows, but as the Director of Agriculture has informed me, it is not present in general to a very large extent. It is more common in the case of breeding herds. The tuberculin test has been applied systematically since 1914, and the investigations of Mr. Lionnet between that date and 1919 showed only 3 cases of tuberculosis among 310 milch cows examined in 19 different towns and villages, and 8 private dairies. As Mr. Lionnet points out, the figure 310 represents a comparatively low proportion of the total number of milk cattle in the island.

It would seem, at least so far as breeding herds are concerned, that the infection may be heavily localised at one or two points. This is borne out by figures furnished me by Dr. Tempany regarding the work done since 1919. These unfortunately refer only to breeding herds and need not here be quoted. They show that the district of Savanne yields the highest percentage of reactions.

Cowsheds.

It is, however, after it leaves the cow that the milk becomes exposed to conditions which render it unfit for human consumption. In the first place the cowsheds as a rule are of the most rudimentary kind, being, for the most part, merely straw huts (Figs. 100 and 101), owned by Indians, in which the milch cow is kept permanently tied up save on the occasions when she is removed for a short space to be served by the bull.

The floor of the cow shed lends itself to pollution. It consists of cow-dung and earth beaten hard, large flat stones set in the ground with interspaces between them or what is known as " ciment batard " which usually consists of a mixture of broken stones, sand, lime and red earth.

The commonest type is the cow-dung floor, but that with flat stones is not infrequently seen. The floor is usually covered with grass, straw or cane leaves.

The drainage, consisting of urine mixed with excrement, passes to a small uncovered pit just outside the shed. As may be imagined, milking is not conducted under ideal conditions, though it is only fair to state that the coats of the cows are not specially befouled with excrement. I have seen animals surprisingly clean considering their surroundings. This may be due in part to the thick bedding, and the care the Indian cow-owner bestows on his or her beast.

The cow is milked into a tin of an old fashioned type, and may or may not have water added to it. I understand the cow-keeper is by no means always guilty of watering the milk, though doubtless a certain proportion practice the fraud. The small quantities of milk obtainable from individual cow-owners are purchased by middlemen or agents of butter factories, many of which are exceedingly insanitary places and should not be permitted to exist. Here the milk is not infrequently watered and, moreover, the fresh milk is mixed with " separated " milk. The mixture is then boiled and sold through the agency of milk vendors as " skimmed milk," the sale of skimmed milk being permitted by law, a point to which reference will be made later.

Insanitary conditions.

Sophistication of milk.

The milk vendors are provided with tins of a fairly good type (Fig. 102), but many of them are known to be dishonest. They may reboil the milk to make sure that it will keep, they often water it, and indeed I am told that when sealed tins were provided they bored holes in the bottom of the vessels and squirted water into them, thereafter cleverly sealing the punctures. Sophistications of various kinds, *i.e.*, addition of flour, carbonate of lime or bicarbonate of soda are practised, and the hapless consumer has to pay for a product which, whatever it may be, is certainly not milk.

Milk tins.

On one occasion " millions " fish were kindly supplied along with the milk ration, and this to a Government hospital.

It is the poor who suffer chiefly, as do institutions such as hospitals, infirmaries and crèches.

The latter should soon be in a better position, for H. E. The Governor has taken steps to establish a Government dairy on a large scale at Curepipe, and with the help of the Director of Agriculture, and of information obtained from India, hopes soon to be in possession of a well planned and up-to-date institution.

Government dairy, Curepipe.

Further, private enterprise has recently started a dairy farm at Chebel in charge of a Manager trained at the Agricultural College, Potchefstroom, in the Transvaal. A good race of milch cows has been introduced, dairy utensils of the best, and there is every promise that, given sufficient support, this experiment will be successful and supply a felt want. At the same time there is a minimum at which milk produced under sanitary conditions can be sold by a private company. In some cases dried milk, an excellent product, may be imported, but this also costs money and brings no nearer the solution of what is to be done regarding the milk-supply of the poorer classes. In the first place there is the question of the cowshed. The cow owners are not wealthy and cannot afford to spend money on elaborate cowsheds.

Private dairy, Chebel.

As far as the superstructure goes a cheap type, devised by Dr. Castel, was seen at Belle Vue (Harel) Sugar Estate, Pamplemousses. Each shed cost only Rs. 70 and was much airier and better lighted than the customary low dark structure. This type might be generally adopted and gradually introduced. The main trouble is the floor.

Improvements in cowsheds.

Building.

In many parts of Africa, notably perhaps in Zululand, excellent cow-dung floors are made with ant-hill earth which are so hard and free from cracks that cattle can be stabled upon them without much nuisance resulting. Owing possibly to the fact that the proper kind of earth for mixing with the cow-dung is not forthcoming in Mauritius the Indian does not seem able to make a satisfactory floor of this type.

Floors.

At my request the Director of Agriculture kindly carried out some experiments with the following kinds of floors for cow-sheds :—

(1) An ordinary cow-dung floor.
(2) A special cow-dung floor in which the earth and dung were worked up with a little kerosene.
(3) A floor of large stones bedded irregularly in the ground.
(4) A " ciment batard " floor.

I had hopes that the addition of kerosene to the earth and cow-dung might have a binding effect, and also help to keep the floor sweet, but this appears not to be the case. The trials were not concluded when I left, but it would appear that the " ciment batard " floor is the best of what must be termed a " bad lot." Unfortunately such a floor costs a good deal, and I fear, will require fairly frequent renewal.

Under the circumstances it is difficult to know what to advise. I think that experiments should be carried out to see if some cheap kind of non-porous floor cannot be obtained. There may be a kind of earth like ant-hill earth suitable for the purpose. The effect of admixture of earth with crushed coral might be tried, though I am very doubtful if it would answer. Still it is worth testing for coral is easily obtainable and, if ground small, might not prove too porous.

Drainage.

As regards drainage I think the pit might give place to a proper covered soak-away wherever the sub-soil is suitable.

Milk depôts.

The whole milk trade requires careful supervision. A meeting, presided over by the Colonial Secretary, was held at Curepipe where the question was discussed and it was agreed to establish milk depots to which the milk vendors would bring their supplies. There the milk could be tested and then, if satisfactory, sent out in sealed tins of a special pattern furnished with taps, and it would be the consumer's business to see that the milk was supplied from the tap.

The whole scheme bristles with difficulties. For one thing there would have to be random sampling, for another it must be remembered that a lactometer test alone is not sufficient and that reliance cannot be placed on the lactoscope. It will be necessary to use the lactometer for the specific gravity test, the Gerber apparatus for fat estimation and the Richmond slide-rule for calculating the total solids. All this means a trained staff and will prove expensive, although the Colonial Secretary has succeeded in getting on loan some suitable buildings for depôts from the Military Authorities.

An extension of the depôt system with arrangements for collecting and distribution was considered and formed the subject of a memorandum by the Director of Agriculture. I fear the cost, which is very great, is prohibitive, but doubtless information will be forthcoming from the limited schemes, and conditions can be gradually improved.

Dairy in Port Louis.

The establishment of a sanitary dairy in Port Louis for the sale of good milk is a measure which should be carried into effect.

The question of Pasteurisation was considered, but it is not likely to be successful on a large scale.

Butter factories.

Certain points in connection with the legal aspect of the question will be found mentioned in the section of this report dealing with Sanitary Laws and Regulations. The Butter Factories require attention. There is one good factory run on modern lines at the Labourdonnais Estate, Rivière du Rempart. Unfortunately, owing partly to the precautions taken and the restrictions imposed, the milk supply has diminished, being diverted to local Indian factories where the conditions are very unsatisfactory. All these places should be put under strict supervision and made to conform to certain standards.

Care must also be taken to see that every factory which is passed from a sanitary standpoint only sells its own produce. I was informed that it is the custom at one small but well-managed establishment to purchase butter from low-class Indian factories and sell it as the product of the good factory to which otherwise no exception could be taken.

AERATED WATER FACTORIES.

These are represented in Mahebourg, Curepipe and Vacoas, but the majority are in Port Louis. They have already been described in the interim reports and there is no need to recapitulate. The important point is to see that they are brought under efficient sanitary control. It has been suggested that they should conform generally to the Egyptian Model Conditions which are very complete and which, for the most part, can easily be followed in Mauritius. As stated copies are available. Aerated water factories. Egyptian Model Conditions.

Special attention must be paid to the manufacture of the various syrups used as flavouring agents while no animals should be permitted on the premises. A memorandum on the subject of aerated water factories was submitted on April 9th, 1921.

ICE.

There are a few ice factories in the Island. They were all inspected and found satisfactory. In one case, however, the sawdust used for packing was kept in a heap outside on the street. The practice was discontinued when the owner's attention was drawn to it and the matter is only mentioned here as illustrating what insanitary things may be done as the result of ignorance or thoughtlessness. Ice.

WASHING AND DISINFECTION.

These two subjects may be considered together as they are closely related. Mention has already been made of the lamentable lack of laundries and the resulting pollution of streams. Washing.

In consultation with the Assistant Director, Public Works Department, a type of field laundry was evolved which is comparatively cheap and which should be introduced where no laundries exist. There are a few open air laundries (Fig. 105), as for example at Mahebourg and Souillac, but the above type is more suitable. One of these laundries has been sanctioned for the Civil Hospital, Port Louis. There should not be much difficulty with the effluent in the capital for it can be admitted to the sewers. In the smaller towns and rural districts, however, it will require purification before being passed into streams. This is best accomplished by the use of lime and bleaching powder or by bleaching powder alone. Laundries.

Particulars will be found in Byam and Archibald's " Practice of Medicine in the Tropics," copies of which are available in the Colony.

A place like Curepipe should have a modern steam laundry. I understand the idea has been entertained by some of the leading inhabitants and unless the proposed field laundries prove sufficient the scheme should certainly be developed. It would probably prove a paying proposition if properly managed.

Anything that will serve to lessen the number of dhobies is to be encouraged, for then it will be easier to deal with those who remain, and who should be under some kind of supervision and be given certain sanitary facilities in their work.

Public baths.

Figs. 103, 104 represent the only public bathing establishment in Port Louis. It is fairly satisfactory, but is not situated in a very suitable part of the town. It is true that in the Place d'Armes there is a wash-house with a spray shower but most unfortunately it is under the same roof as a public latrine. There is a direct connection between them and I found the wash-house being used as a public convenience. A partition should be introduced.

Undoubtedly more public baths are required and they will doubtless receive due consideration in Mr. Mansergh's Report.

It is, of course, impossible to check altogether the bathing which goes on in nearly all the rivers and streams, but there should be some kind of control and persons should be prevented from bathing at places where there is a risk of fouling a water-supply. The provision of wash houses, at least in the larger towns and villages, might help to diminish the nuisance.

Disinfection.

As regards disinfection it must be clear from what has been said about hospitals that little provision has been made either for disinfection or disinfestation. Fortunately Port Louis is in a better position than most places in the Island, for, at the Quarantine Station, there are two steam pressure machines, one a Geneste-Herscher, the other a Manlove-Alliot, and these are available for town as well as port work.

Steam sack disinfectors.

Large plants are now very expensive and very costly to run. Happily, however, there is no need for them in Mauritius thanks to the introduction of the portable and economical Lelean Steam Sack Disinfectors. These have the merits of being very simple, easily worked, and unlikely to get out of order. After consultation with Dr. Momplé I suggested that a certain number should be obtained and, just before I left, three outfits arrived which I have little doubt are giving satisfaction, though I have had no communication about them.

Cyanofumer for bed-bugs, etc.

The railway carriages are infested with bed-bugs, and there are constant complaints regarding the attentions of these insects. Accordingly the recommendation was made that one of Colonel Glen Liston's new hydrocyanic acid gas machines should be procured and used both for the destruction of bed-bugs and also, where it can be safely employed, for the elimination of rats and rat-fleas.

The apparatus is not yet upon the market, and, as a temporary measure, I suggested that the method of Pettit should be followed. It consists of employing, by means of an atomizer, an extract prepared by washing 500 grms. of pyrethrum with 2,000 c.c. of strong alcohol, and then adding 50 grms. of gum camphor, 150 c.c. of cedar wood oil and 25 grms. of oil of lavender. One application, if properly made, is said to be sufficient, about 8 to 10 ounces being required for a railway carriage. The odour is not disagreeable. This would seem to be a suitable method for use in places to which the Glen Liston machine could not be readily transported.

Note on railway van steam disinfector.

If at any time a serious epidemic, say of cholera, typhus or relapsing fever broke out in Mauritius, necessitating disinfection of clothes and bedding on a large scale, it would always be possible to convert one of the closed railway metal vans into a travelling steam disinfector of the type used during the war in Serbia, Egypt and elsewhere. This can be easily and cheaply done and its possibilities should be borne in mind.

OFFENSIVE TRADES.

Offensive trades.

Tanneries.

Apart from the manufacture of manure by the Engrais system, the only offensive trades in Mauritius which appear to merit attention are Tanneries and Aloe Fibre Factories. There are tanneries in the vicinity of Port Louis. They are conducted on somewhat primitive lines and the processes employed are certainly productive of very offensive odours. The buildings, however, are situated a considerable distance from any centre of population and the only real nuisance connected with them was that caused by the fact that refuse, *i.e.*, horns, fragments of hide, etc., was simply thrown into a convenient hollow in the open.

Attention was drawn to the matter which will require supervision.

Aloe fibre factories.

There are a number of Aloe Fibre Factories, most of them situated in the Black River District. A nuisance is created owing to the smell of the waste products and the fouling of streams and ditches by effluent. No one, however, appears to be incommoded, and the nuisances, which can scarcely be called dangerous, may, for the present at least, be ignored.

DISPOSAL OF THE DEAD.

Disposal of the dead.

Cemeteries.

Mosquitoes breeding in cemeteries.

Apart from the cremation carried out by certain sections of the Indian community, earth burial is the only form of disposal employed. A large number of cemeteries were visited and their hygienic relationships were discussed in the interim reports. Some of them were none too satisfactory, being over-crowded and ill-kept, while in certain cases there was a suspicion that the interments were not being properly carried out. Again, many of the better class cemeteries were vast breeding grounds for *Stegomyia fasciata* and *S. scutellaris* (*albopicta*), owing to the presence of flower vases on the tombs and graves. As Fig. 41 shows an effort had been made to deal with this nuisance by forbidding the use of water in these vases and permitting only the employment of wet sand. The regulation was, however, more honoured in the breach than in the observance. I did what I could to get this state of matters remedied and even suggested the use of metal vases with perforated bases which would not hold water, but nothing tangible resulted although the Governor made a spirited appeal. Local prejudice and sentiment are difficult things to combat, but one would ask, what is the good of fighting *Stegomyiae*, the known carriers of yellow fever, dengue and filariasis, in other quarters if they are bred out in thousands in the cemeteries. It is absurd that such a state of matters should persist, and it is hoped that the good sense of the people will eventually permit action to be taken on the lines indicated.

There is need, as has been stated, for the provision of more cemeteries, and the places where they are urgently required, notably Curepipe, Rose-Belle and Escalier, have been listed.

Burning ghâts.

In Port Louis there are burning ghâts. Cremation is conducted in the open and efficient calcining secured, but the arrangements require to be improved from an æsthetic standpoint. At present the ashes and bones remain *in situ*. (Fig. 107.) They should be disposed of in a suitable manner.

STREETS, HOUSING AND TOWN PLANNING.

STREETS.

Streets.

So far as the Tropics are concerned the Americans have probably paid more attention to street hygiene than any other nation. They rightly laid great stress upon it in their Panama campaign, and one of the first things they always undertook when improving the sanitation of a town was to provide it with properly laid and surfaced streets.

Port Louis.

It must be confessed that they would find plenty to do in this direction in Port Louis. While here and there stretches of basalt setts show what might be accomplished (Fig. 108), the streets generally, though often wide, spacious and fairly well drained, have very poor surfaces and are flanked by gutters, gullies and pavements of an unsuitable type.

Many of them are crossed by open channels in which foul water flows, and most of them are very dusty and in a bad state of repair.

It is not surprising, especially considering the paucity of water carts, that it is found difficult to keep them in a cleanly condition.

Street construction and upkeep are very largely matters concerning the engineer, and the unfortunate municipality possessed no expert to advise it on the subject.

It has been thought expedient to place the care of the streets under the Public Works Department, and it is hoped that those which have to sustain heavy traffic will receive radical treatment.

Rectification of streets in Port Louis.

It is very necessary that durable surfaces be provided which can be cleaned by means of the hose. Then it is probable that sore throats and intestinal complaints will cease to be so common as they are at present in Port Louis, and that it will be more pleasant to traverse the capital in a motor car than is now the case. The matter has been considered at some length in Interim Report No. 1, where the relative merits of asphalt and stone setts were briefly discussed. Since writing that report I have had an opportunity of consulting a useful paper by Worrall, and I am inclined to think that for Port Louis the best solution of the problem would be to reconstruct the thoroughfares indicated in the above report with stone setts on concrete, using rock asphalt for the joints. Worrall's paper which bears the title, " The Hygiene of Road Pavements," though it does not deal with tropical conditions, is worthy of study and will be found in " The Journal of the Royal Sanitary Institute," Vol. XLI., 1920-21.

For some of the roads in Port Louis and also in the smaller towns, tarring during the dry season is likely to prove beneficial, now that motor traffic has increased so enormously. In certain places the roads are suffering heavily and dust is proving a serious nuisance. It is clear that here and there new foundations are required, but I do not wish to trench on the domain of the engineer. There are so many roads in Mauritius and many of them are such fine thoroughfares that the cost of upkeep is very heavy. I mention the matter solely on account of its hygienic importance, though with the disappearance of the horse and mule the situation in the smaller towns is now possibly not so serious.

HOUSES.

Houses.

His Excellency the Governor has drawn attention to the evil results of the poor housing conditions and the overcrowding which exists. These are naturally more marked in Port Louis, but they are evident everywhere and call urgently for remedy.

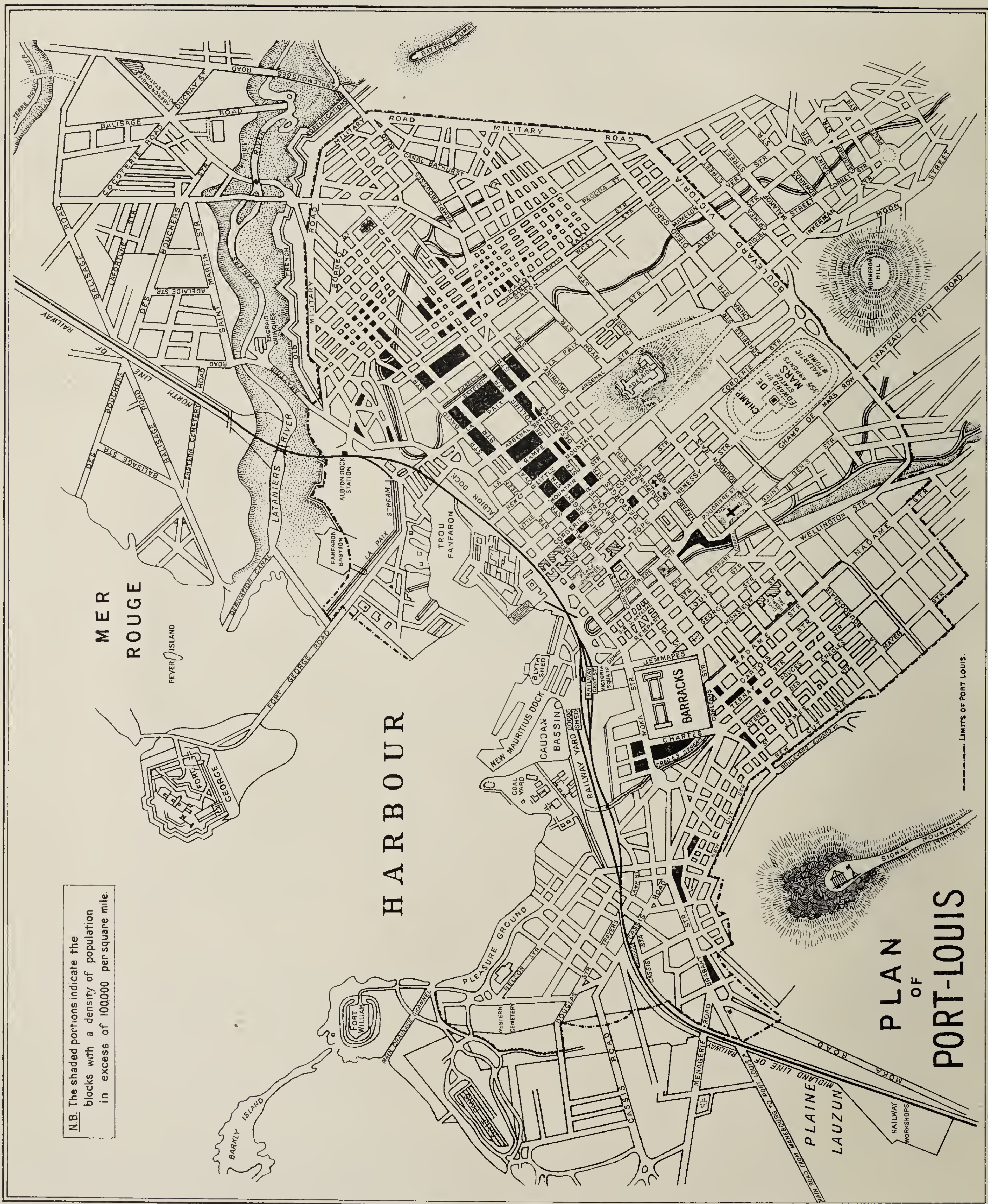
It seems advisable in this connection to quote a few paragraphs from the report on the Sanitation of Port Louis.

Buildings and housing conditions.

Deterioration of house property.

" Much of Port Louis may be compared to a rabbit warren. Although the town as a whole was originally laid out on good lines it has been allowed to degenerate in a haphazard manner. It has suffered from the curse of sub-letting and the lack of proper sanitary control. For years it has been on the downgrade. Old mansions (Fig. 112), roomy houses, spacious yards have all deteriorated. Most of the shops and warehouses are poor and

PLAN IV.



PLAN OF PORT LOUIS. Shaded portion indicates blocks in which density of population exceeds 100,000 persons per square mile.
After A. Walter, F.R.A.S.

dismal-looking places; the majority of the houses have either been turned into insanitary business premises or have been divided up into one-roomed dwellings. Old wooden buildings round the sides of yards; originally outhouses, servants' quarters, stables, etc., have been similarily converted. (Figs. 120-122.) In some instances the centre of the yard has not been left vacant and, as a result, light and air have been excluded. The landlords, as a rule, have adhered to the building regulation which lays down the minimum dimensions of every room intended for human habitation at 10 feet by 10 feet by 10 feet. There, however, the matter rests. There is no limit to the number of occupants. I have found as many as nine in a room of this size. There is frequently no window whatever and back-to-back premises are not uncommon. It is true that during the day the occupants are usually elsewhere: the man out at work, the woman washing or cooking in the yard, the children at school or at play. Even if in the room, its door is open and there is some degree of ventilation, though in most cases there is little air movement, which recent work has shown to be the chief factor in ensuring health and comfort. At night, however, and I can speak from personal experience, every door and window is closed, and the unfortunate people live in a stifling atmosphere under conditions most favourable to the spread of pulmonary tuberculosis and pneumonia and which cannot fail to encourage alcoholism.

Over-crowding.

Conditions at night.

" Even in the better-class rooms the amount of air-space is limited, for many of them are half-full of furniture, which diminishes the amount available.

"With the assistance of Mr. A. Walter, I measured some of the rooms and, making the usual deductions for furniture, find that the *average* cubic space per head works out at about 200 cubic feet. This is bad enough, but far worse is the stagnation of air at night and the general overcrowding."

Observations on ventilation.

As regards the latter, Mr. Walter obtained some valuable statistics in the course of his last census work, and was able to show clearly that the highest mortality occurred in the sections of the town which were most overcrowded. Plan IV. reproduced from the Mauritius Almanack, 1921, shows in black the areas where there is a density of population in excess of 100,000 per square mile.

In some of these areas, as well as elsewhere, common lodging houses exist of a type which should not be permitted. Dark, dirty, ill-ventilated and rat-ridden, with rooms completely closed at night so that the air is foetid, these scandalous places are foci for the spread of phthisis and other diseases. Some of them are much worse than others, but the majority should be condemned and either materially altered or evacuated. That decent buildings of this class can be maintained is shown by the premises belonging to Mr. A. Allagapam Nainar, President of the " Congregations des Hindous de Maurice," and leased by him to tenants who are encouraged to live in a cleanly manner amongst hygienic surroundings.

Special legislation is required in connection with common lodging houses, both in Port Louis and elsewhere, although conditions are not so bad in the smaller towns, there being usually more space, air and light.

Common lodging houses.

In the outskirts of Port Louis many poor Creole families live in what can only be described as shanties or hovels. (Figs. 109-111.) Many of these patchwork sheds are unfit for human habitation and should be demolished, but the difficulty is where to house their occupants. His Excellency the Governor has developed a model village at Cassis, on the outskirts of the town. (Figs. 123, 124.) The cottages are well built and well arranged. There is a pleasing diversity of type which furnishes information as to the most suitable pattern and also as regards cost. There are communal kitchens,

Housing conditions.

Model village, Cassis.

water has been laid on and sanitation has received careful attention. This scheme is undoubtedly a step in the right direction, provided care is taken to see that the dwellings are leased to those urgently in need of them and who have hitherto been living amongst insanitary surroundings. I understand that financially the scheme is a success and that there has been a great demand for the houses.

It is now intended to create a similar location for the railway workers at Plaines Lauzun, and for this purpose a sum of Rs. 150,000 is required from the Improvement and Development Fund.

This appears to me a reasonable charge against the latter, but I do not think that more should be taken from this Fund for housing purposes. It is true that the importance of improving the housing conditions can scarcely be exaggerated but the needs are so extensive that to carry out the work properly nearly the whole of the Rs. 10,000,000 would be required and nothing would be left for improvements quite as pressing and more easy of attainment.

Expropriation scheme for Port Louis.

An effort should, I think, be made to follow what has been done in other places, and, so far as Port Louis is concerned, to raise a loan on good security and proceed to an expropriation of some of the worst areas in the town, paying special attention to the locality lying north east of Royal Street owing to its close proximity to the harbour and the fact that it is apt to be infested by plague rats.

I do not suggest that the buildings taken in hand should be demolished. Many of them possess good external walls, but I submit that they should be acquired, gutted and converted into commodious and rat-proof shops and warehouses. It is no use trying to do the thing piecemeal. There are far too many owners concerned, and it is hopeless in most cases to render the inhabited portions hygienic without altering their immediate surroundings. Here and there the changes need not be extensive, but it would be well if the whole locality was made into a business section and ceased to be residential.

The persons evicted would find accommodation in a new model quarter, which I think should be erected on the lower north-eastern slope of Signal Mountain, a locality at one time the seat of fine mansions, but deserted since the great cyclone of 1892, and now covered with grass and dotted over with trees and bushes.

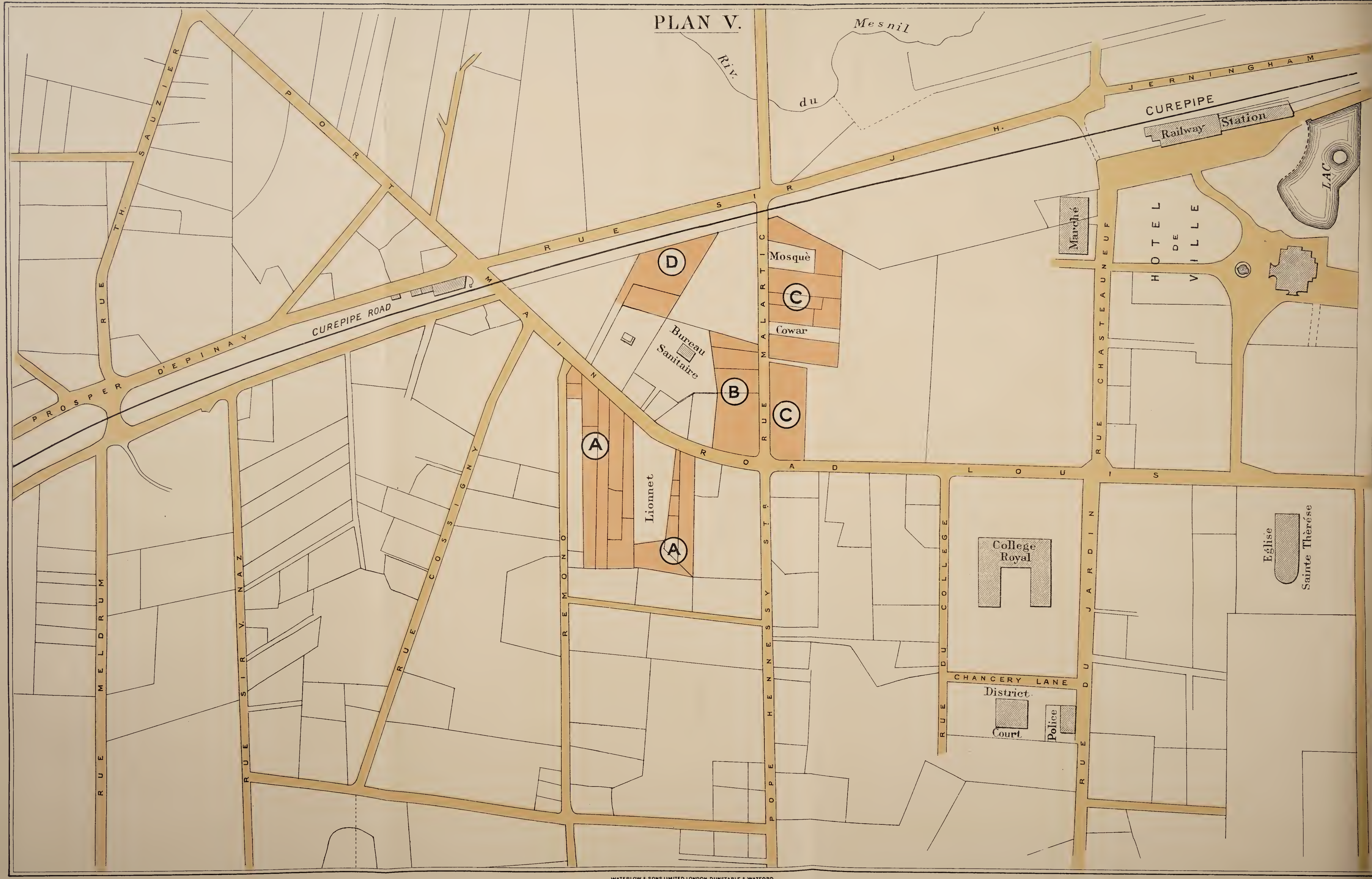
Site for new part of town.

This is a fine site for building purposes, there being ample space, a gentle slope, a pleasing prospect, good drainage and few anopheline breeding places in the immediate vicinity. Moreover it is readily accessible and there is usually some breeze to be obtained. Water can easily be supplied, and there should be no great difficulty in the lay-out. The question of planning will be considered later, but, taking the scheme as a whole, I should think that if it were conducted on sound lines it would very likely prove remunerative in the long run.

Reconstruction in Port Louis.

Let it be remembered that there is scarcely a decent-looking shop in Port Louis, that is to say as viewed from the exterior; that the main artery, Royal Street, is by no means an imposing thoroughfare, certainly it ill-befits its name; that the warehouses are congested and inconvenient and that there is a medley of godowns, shops, common lodging houses, Chinese restaurants, work rooms of various kinds, private dwellings, passages, yards, outside stairs, verandahs, fowl houses, latrines, sinks and so forth, which baffles description. Much could be accomplished by taking the worst sections on each side of Royal Street, and it might very well be done as a business proposition and altering them as indicated, taking care to put in fine windows on

PLAN V.



WATERLOW & SONS LIMITED, LONDON, DUNSTABLE & WATFORD.

the front, and to afford ample facilities for ingress and egress. I am inclined to think that the inhabitants tolerate Royal Street partly because many of them have never seen anything better. Originally the thoroughfare must have been a fine road. It is long and fairly wide, and a hundred years ago the buildings flanking it were no doubt respectable and up-to-date. Nowadays, though possibly worthy of the present Port Louis, it is unworthy of Mauritius, and unless materially altered will prove unworthy also of a town with sanitary pretensions.

It will be no easy matter to reconstruct even a limited area of Port Louis, but I am persuaded that it is a necessity that work of this nature should be undertaken if it is desired to make the town healthy. Too ambitious a project is to be avoided, for it is possible that once wealthy merchants and property owners see what has been accomplished and the resulting benefits, they will be willing themselves to undertake reconstruction work, not from philanthropic motives, but for business purposes. Government, however, would require to make the first move.

Slum areas, Curepipe.

Slum areas, sad to say, exist at Curepipe. (See Plan V.) They are described in Interim Report No. 3, p. 23, where it is pointed out that, according to the estimate of Mr. Marion de Procé, Architect of the Board of Commissioners, a sum of Rs. 242,300 would be required to purchase them with a view to clearing them out and replacing them by decent buildings.

Coolie lines in sugar estates.

Contrast with conditions in Java and Sumatra.

A good deal has been said in the interim reports about housing conditions in the smaller towns and the rural districts. Frequently the lower class Indian and Creole population will be found living in buildings of a very poor type (Figs. 109-111), but it is significant that when the Indian makes money one of the first things he does is to erect a good house. (Fig. 113.) This was specially noticeable in the neighbourhood of Triolet, Pamplemousses. Almost without exception the coolie lines on the sugar estates were poor. Figs. 115-118.) How poor they really are is scarcely apparent until one compares them with the type of houses provided for native labourers on the rubber estates in the Dutch East Indies as illustrated in the report of Snijders and Baermann.

In the past, of course, Mauritius has been poor, at one time indeed desperately poor, while the Dutch Islands have been rich almost beyond the dreams of avarice, but nothing can excuse the conditions obtaining at the present time on some of the Mauritian estates. These have already been mentioned elsewhere, and measures have, I believe, in some cases been taken to bring the owners to a sense, not only of their responsibility, but of their crass ignorance and stupidity in permitting a state of things to exist which is so detrimental to their own interests.

What will happen in the future it is hard to say. Indentured labour no longer exists, and in all probability the Estates will not continue to be responsible for housing their coolies. It is to be hoped, in such an event, that the latter will not be left to their own devices, for the existing free Indian locations are usually examples of how houses and villages should not be built.

There will be a great opportunity for Government to make a radical change, and it is to be hoped that the Dutch reports will be carefully studied and Dutch methods, so far as the designing of houses and hospitals goes, followed, at least to some extent.

Reconstruction of Indian locations.

The Colonial Secretary hopes to take in hand some of the ordinary Indian locations and improve them by segregating the villagers' cattle and goats in special areas reserved for the purpose. These will be near but separate from the locations, and this step in itself may help to lessen the malaria incidence, the cattle serving as blood reservoirs for *A. costalis.*

Thereafter it may be possible to improve matters as regards the houses and their annexes, especially the latrine buildings. This, however, is a question more nearly related to the next subject, *i.e.*,

TOWN-PLANNING.

Town-planning.

So far as Port Louis is concerned it appears advisable to reproduce here a memorandum submitted to the Colonial Secretary, Mauritius, on August 22nd, 1921. It is as follows :—

" In view of the recommendation that has been made as regards the construction of a new, hygienic quarter for the town of Port Louis, and the necessity in Mauritius of paying much more attention than in the past to the lay-out of towns and villages, it appears advisable to submit a few notes on certain aspects of town-planning in the tropics.

Memorandum on :—

" (1) It is very important to have type plans prepared for habitations and premises of different kinds and more especially for Indian dwelling-houses and Chinese shops. Until a special Sanitary Engineer, attached to the Medical and Health Department, is available, such type plans should be prepared by a Sanitary Officer of experience in consultation with the Director or Assistant Director, Public Works Department.

" (2) As Professor Simpson has pointed out in connection with East Africa and Uganda it is inadvisable that plots leased to Indians of the labouring classes should be larger than 50 feet by 100 feet. This is on the *liberal* side but in any case there should be stringent regulations forbidding sub-division of the plot and indicating the buildings which may be erected upon it. All plots should be fenced by the owner.

" (3) No house including verandah, if there is one, should cover more than half the area of the plot, and that portion of the yard which is entirely free of any building should be 80 yards square and have a minimum width of 8 linear yards. Latrines should be at least 25 feet from the dwelling house, unless they are of the water-closet type. This rule already obtains in Mauritius.

" (4) A suitable type of plot is one 80 feet in depth, the main building being 40 feet in depth. A maximum house depth of 40 feet permits free perflation of air, and a yard 40 feet in depth provides adequate open space and sufficient room for the erection of a kitchen and latrine.

" (5) It has been found in Rangoon that if a space of 10 feet be left between the walls of adjacent buildings, an excellent provision, a convenient house having 30 feet of frontage and 40 feet of depth can be erected. If a larger building be desired two contiguous lots should be acquired. If no space can be left between buildings then the frontage for small houses should not be less than 40 feet, while for larger dwellings it should be 50 feet.

" (6) The maximum height of buildings should be defined. For example, in part of a town inhabited by Indians and Creoles, houses of more than one storey should only be permitted when the street faced by them is 50 feet wide.

" (7) In business areas, when the premises are large and are not used for domestic purposes but guarded only by a watchman, the main building should not occupy more than two-thirds of the plot.

"(8) The length of block frontages is a matter of some importance, but must be determined by local conditions. As a rule it is not convenient to have a frontage greater than 700 feet without the interposition of a cross road.

"(9) The lay-out of markets for new towns merits attention, and, speaking generally, it may be said that a square 400 feet by 400 feet with a 60 foot road all round is suitable as a minimum requirement. Care should always be taken to prevent encroachment on market areas.

"There are other matters requiring consideration, such as the number and siting of public latrines and urinals, the provision of open spaces, etc., but these depend so much on local conditions and the latter vary so greatly that it is not advisable to lay down rules regarding them.

"The above suggestions may require modification. They are merely put forward as guides to what is required and to ensure that the more important subject of town-planning receives due consideration from a hygienic point of view.

Necessity of submitting all building plans to Sanitary Authority.

"Whatever be done in this direction overcrowding must always be prevented, and it is of course essential that all plans should be approved by the Sanitary Authority before any building is permitted."

Large scale map, Port Louis.

As a preliminary step I asked that a large scale plan of Port Louis should be prepared for the use of the Medical Officer of Health, showing in detail the arrangement of houses, yards and annexes, all buildings of sanitary importance, *i.e.*, latrines, outside kitchens, wash houses, stables, etc., being specially marked.

Clearing operations, Port Louis.

Mr. Walter was the only person who possessed the necessary information, which he kindly collected during his census visits, and he was good enough to supervise the production of the map. It had not been completed prior to my departure, but should serve as a useful basis for reconstruction work in the future. As Chadwick reported long ago, the town is far too much scattered and could with advantage be concentrated, provided overcrowding is avoided. It is hoped that a good many insanitary dwellings in the Tranquebar and Pitot Valleys will be swept away when the clearing operations advocated in connection with the anti-malaria measures are carried out.

Waste areas.

The curse of the prickly pear.

Method of destroying the prickly pear.

In all the towns attention must be directed to waste areas. Some of these are heavily overgrown with bush and that enemy of the Hygienist, the prickly pear, *Opuntia monocantha* (Fig. 126), conceals all kinds of nuisances including mosquito-breeding places. Petroleum fire sprays are likely to be useful in dealing with some of these spots, while I understand that a method of destroying the prickly pear has been used with success in South Africa. Dr. Gilchrist wrote for details of the process which consists in utilising an Indian species of cochineal insect. Lounsbury has reported that "The Indian species has a pronounced blighting effect that is quite in contrast with the comparative harmlessness of the Cape species. Where it settles the new growth of the plant becomes contorted, yellow blotches appear, and as the attack continues, the joints wither and decay. Young plants three or four feet high die in a few months."

He also states that

"To get the insect started at a new place nothing more is required than to put an infested joint in contact with a Monocantha plant. It is well, however, to jar some of the insects off the plant and then to tie the infested joint in a sheltered position face to face against a green joint, as by these means fewer of the insects are lost."

Further information on the subject will be found in the Tropical Diseases Bulletin, Vol. 15, No. 5 of May 15th, 1920, of which there is a copy in Mauritius. It would certainly appear advisable to carry out some experiments with material from the Union of South Africa.

Planting of eucalyptus inadvisable.

It has been the custom to plant waste land with eucalyptus, but what little good these trees may do in the way of drying the soil is more than counterbalanced by the fact that they afford shelter to adult mosquitoes. This has been recognised in Southern Italy and elsewhere, and it has been found advisable to cut down eucalyptus groves of many years' growth. It is better to leave the land under grass, which should be prevented from becoming too luxuriant. A matter of special importance is the demolition of ruined buildings, at least anywhere in the neighbourhood of populous centres. They are always used as public conveniences, and are therefore a source of nuisance and possibly also of danger.

Provision of open spaces and recreation grounds

The Colonial Secretary has directed attention to the necessity of providing open spaces for recreation purposes. Port Louis has a fine "lung" in the shape of the beautiful Champ de Mars (Fig. 125), of which more use might be made as a public play-ground, but the other towns lack such facilities for the poorer classes. A suggestion that an old disused cemetery at Rose Hill abandoned 50 years ago, much over-grown, untidy and in which practically all the records of the dead had vanished, should be turned into a recreation ground excited horror in the minds of a section of the community despite the fact that instances were cited where similar action had been taken with much advantage. I fear it will be many years before old cemeteries can be utilised in this way in Mauritius. This is unfortunate, for it would be an economical method of obtaining open spaces which would constitute a great boon to the inhabitants, more especially the children, and afford a means of combating idleness and its sequelæ, alcoholism and crime.

Very little is done in the way of organised games at the Government and lower class private schools, but I am certain that Mr. Denham, who took such an interest in these matters in Ceylon, will not rest until he has effected a much-needed change in this direction.

SCHOOLS.

Schools.

This was one of the subjects to which very particular attention was directed in the interim reports, and with good reason, for the sanitary state of the great majority of the government and aided schools was, to put it quite plainly, disgraceful.

Reference has already been made to the large amount of illness amongst the pupils and also to the latrine accommodation which was condemned by Kendrick and about which I found it necessary to protest repeatedly, but there are other matters to which attention must be directed.

Importance of suitable school buildings.

Those who value religion realise that places of worship should be made distinctive, and many also agree that they should be beautiful and calculated to impress those who carry out in them the devotional exercises on which they lay such store. There are many large and fine churches in Mauritius on which much money must have been spent and the majority of which are kept in good condition.

Not so the public schools and yet the latter are much more occupied than the churches, play as important a part in the lives of those who attend them—indeed without some education the churchgoers could not understand the dogmas to which they subscribe—and are concerned with human life at an impressionable age and also at an age when disease-resisting powers have not been fully developed. Hence it would seem there was a sound argument for expending at least a reasonable amount of care and money on school buildings.

On the contrary, what do we find? Rarely, very rarely, has a building been erected purposely to serve as a school and even when this happens to be the case the laws of school hygiene have too often been ignored. As a rule, any structure which happens to have been obtainable has been converted for school purposes. It may be a barn, it may be the deserted hospital of a sugar estate, it may be an old dwelling house. I inspected schools which were not weather-proof; others below the level of the road and recipients of the road washings after heavy rain, others very badly illuminated although on the walls there might be notices abjuring the pupils not to read in a bad light. As a rule, the ventilation was fair, sometimes because the buildings were more or less ruinous, but, as has already been said, the latrine accommodation was nearly always unsuitable and in some cases in a disgusting and dangerous condition.

There was little to choose between the government schools and the aided schools belonging to various denominations. In all the latter a propagation of religion was a leading feature but unhappily many of them were also propagating flies and ankylostomes.

Unsatisfactory school conditions.

Apart from the question of buildings the conditions were frequently unsatisfactory. Overcrowding was common, desks and benches were badly designed and wrongly placed, there was nothing in the shape of cloak-rooms and in many instances there was no lavatory accommodation. How can children be expected to respect education when it is imparted to them in temples of this nature? I do not mean to suggest that all the school buildings in the Colony are bad. In a few cases schools were housed in chapels under quite satisfactory conditions save as regards sanitary conveniences, and here and there the premises were commodious and the schoolrooms well lighted. These, however, were exceptional cases, as a study of the records in the interim reports will show.

From the health point of view, if for nothing else, I would urge that, if at all possible, a building programme be framed and carried into effect. The Colonial Secretary has had much experience in connection with school construction in Ceylon, and though structures suitable for that Colony may not always be the best for Mauritius, the principles on which the designs of hygienic school buildings are based remain the same, and Mr. Denham's familiarity with them should be utilised to the best advantage. Dr. Gilchrist will also be able to render valuable help, as he has had much to do with schools and school inspection in South Africa.

Teaching of hygiene in schools.

Hygiene is taught after a fashion in Mauritian schools, but I regret to say the lessons do little good. They are not supplemented by diagrams, specimens or models, and too often go in at one ear and out at the other.

The pernicious system of payment by examination results is in force, and, so far as I can see, and I know authorities who agree with me, education in the true and fine sense of the word can scarcely be said to exist.

It is not, however, my province to comment on education as a whole, so I will confine my remarks to the training in hygiene.

In the third interim report I stated that there would be far fewer people indifferent or actually hostile to the claims of sanitation if the children were properly trained at school.

At present their course in hygiene often starts with dry facts about human anatomy and physiology, though I understand an improvement has been recently effected in this particular. Much of what they learn is beyond them and they acquire a dislike to the whole subject. When they do reach the sections which might interest them they have to learn facts by rote, facts which they can repeat in a parrot-like fashion, but without any real understanding. The whole thing is a waste of time. Indeed it is worse, for it engenders a distaste for anything bearing the name of hygiene.

The Teachers.

No one should be asked to teach the latter who does not appreciate its true meaning, and who has not been trained to use his or her powers of observation in the daily things of life. No child should be forced to learn the subject unless the teacher is supplied with pictures and diagrams, many of which can be made exceedingly attractive, and is prepared to supplement the mere book work by lessons in the field and by the display of specimens, as, for example, mosquito larvæ and pupæ, various species of noxious insects, samples of food stuffs, small cheap models of sanitary contrivances and so forth. In every school indeed there should be a little sanitary demonstration centre like those so effectively employed during the war, and the proper preparation and cooking of food should be taught.

Sanitary Demonstration Centres.

A distinguished officer of the Indian Medical Service has written an admirable sanitary primer for school children. It is in the form of a series of stories and has been found most useful.

Indian primer.

No one who has read the tale of how plague was stamped out in the town of a certain Rajah will ever forget the association of rats and human plague. It is a kind of fairy tale, but running through it is the golden thread of truth.

It was a pleasure to find that the Colonial Secretary was acquainted with this work and had taken steps to get copies introduced in the schools in the Colony.

Need for special Mauritian primer.

It is attractively illustrated and, though it deals with Indian conditions, it will serve the purpose until some one writes a similar book expressly for Mauritius. It is true that Dr. Cretin's book deals with Mauritian conditions, but it is neither complete nor up to date, and is in the form of a catechism, which is undesirable. Still it is better than Pouzet's primer, which is quite unsuitable and should be suppressed.

Mr. Souter, the Acting Superintendent of Schools, took an interest in this matter, and I hope that now an improvement has been effected. It is indeed high time that some action was taken to save the children and to educate them in cleanliness and the principles of health.

Necessity for educating people properly.

It is no use having teachers of hygiene who know next to nothing about it. These are merely blind leaders of the blind. It is better not to attempt to teach the subject at all unless it is properly taught, and for that purpose the teachers themselves must receive practical instruction and, for the children, there must, as stated, be an abundance of diagrams and pictures and demonstrations. Taught in this fashion hygiene becomes one of the most interesting of subjects. Nothing is more attractive and wonderful than the evolution of the mosquito from egg to imago, and there is, unfortunately, abundant teaching material so far as mosquitoes go.

Children would speedily become interested in these matters and familiarity with them, far from breeding contempt, would, in many cases, stimulate to sanitary endeavour. It is, however, no use teaching hygiene even in this way if the child sees its canons wholly ignored, both inside the schoolroom and immediately outside it.

I earnestly trust that this matter of the children will receive the attention it merits, that the schools will be put into a sanitary condition and that sanitation will be taught on sound lines and by the graphic method which alone can be successful.

Better class schools.

In most of the better class schools the conditions obtaining do not call for such strictures. Some of them are very good as may be seen by reference to former reports, but in all of them the teaching of hygiene could be improved. It is given a secondary position and more stress should be laid upon it and the lessons should be made more attractive and be supplemented by practical instruction of a simple kind.

The Royal College.

Agricultural College.

In the Royal College hygiene does not figure in the curriculum but benefit would accrue if time would permit of its inclusion. As Dr. Barbeau pointed out to me the Managers of Sugar Estates have usually been boys at the Royal College, and they would look upon sanitary matters in a different way if the importance of the latter were impressed upon them in their early years. In a place like Mauritius it is very easy to obtain subjects for study. A short walk in and around Curepipe would furnish material for quite a lengthy discourse on various aspects of sanitation. In addition, as Dr. Tempany has suggested, the aid of the Department of Agriculture might be enlisted, and if an agricultural college is established an attempt might be made to organise regular courses of lectures on certain aspects of tropical hygiene for the benefit of students, planters and estate owners.

Training School for Teachers.

It may well be said that " now is the accepted time, now is the day of salvation " and, personally, I believe that the hygienic future of the Colony rests very largely with the schools and that without their co-operation the health campaign will be delayed and crippled. Happily, owing to Mr. Denham's exertions a Training School for teachers is to be instituted at Curepipe. When this is an accomplished fact it will be possible to instruct the teachers on proper lines in the principles and practice of hygiene, and then we may look forward with confidence to better things.

PRISONS.

Prisons.

Fine Civil Prison at Beau Bassin.

It seems strange that the prisons are as good as the schools are bad. Indeed, the Civil Prison, Beau Bassin, is the best prison building I have seen in the tropics and the smaller prison in Port Louis is well designed. Both are kept spotlessly clean and from a sanitary standpoint were a pleasure to inspect. A high standard is, of course, to be expected where there is discipline and plenty of labour, but even so, the prisons merit commendation. The Port Louis prison is in the sewered part of the town; that at Beau Bassin was being provided with a water-carriage system and a septic tank.

Beds.

The type of bed provided for prisoners struck me as being very good and worthy of imitation in certain other British Colonies.

Dietary.

An enquiry into the dietary showed that it was adequate. It had proved satisfactory, and the prisoners did hard work upon the ordinary scale. Under these circumstances, I advised that it should not be altered. The scales are here reproduced, as they have stood the test of time and are well balanced.

PRISONERS SCALE OF RATIONS.

Articles of Diet.	A.—NORMAL DIET.							
	Scale 1. Convicted prisoners performing hard manual labour, including stone breaking, road making or other public works or employed in the workshops.				Scale 2. Convicted prisoners performing light or no work, and unconvicted prisoners.			
	Week days		Sundays and Holidays.		Week days.		Sundays and Holidays.	
	Breakfast	Dinner.	Breakfast.	Dinner.	Breakfast.	Dinner.	Breakfast.	Dinner.
	Grammes.		Grammes.		Grammes.		Grammes.	
Beef (2)...	—	—	—	—	—	—	—	—
Tripe (4) §	—	75	—	—	—	60	—	—
Salt Fish (5)	40	—	30	30	40	—	30	30
Bread	—	—	—	—	—	—	—	—
Rice or Maize (6) ...	250	250	225	225	225	225	225	225
Dholl, Lentils or Beans (7)	75	75	75	75	75	75	75	75
Green Bredes *... ...	50	50	50	50	50	50	50	50
Pot Herbs	50	50	50	50	50	50	50	50
Pistachio Oil	10	10	10	10	10	10	10	10
Curry Stuff	—	1	—	—	—	1	—	—

Articles of Diet.	B.—SPECIAL DIET (1).							
	Scale 1. Convicted prisoners performing hard manual labour, including stone breaking, road making or other public works or employed in the workshops.				Scale 2. Convicted prisoners performing light or no work, and unconvicted prisoners.			
	Week days.		Sundays and Holidays.		Week days.		Sundays and Holidays.	
	Breakfast.	Dinner.	Breakfast.	Dinner.	Breakfast.	Dinner.	Breakfast.	Dinner.
	Grammes.		Grammes.		Grammes.		Grammes.	
Beef (2)...	—	90(3)	—	—	—	—	—	—
Tripe (4) §	—	100(3)	—	—	—	60	—	—
Salt Fish (5) §	40	—	40	40	—	—	40	40
Bread	100	100	100	100	100	100	100	100
Rice or Maize (6) ...	125	125	125	125	125	125	125	125
Dholl, Lentils or Beans (7)	75	75	75	75	75	75	75	75
Green Bredes	50	50	50	50	50	50	50	50
Pot Herbs	50	50	50	50	50	50	50	50
Pistachio Oil	10	10	10	10	10	10	10	10
Curry Stuff	—	—	—	—	—	—	—	—

Notes—The weights are those of the uncooked ration on issue. Salt shall be added in sufficient quantity in cooking all diets.

Tea or coffee may, at the discretion of the Medical Officer, be issued before the commencement of the day's work to prisoners who are working in unhealthy places.

(1) European prisoners or prisoners for whom the diet specially ordered by the Medical Officer of the Prison.

(2) The weight is that of the uncooked ration, free from bone.

(3) Beef to be issued on two days in the week.

(4) In the case of prisoners prohibited by religious, race or caste prejudices from eating tripe, pulse may be substituted for tripe in the ratio of 25 grammes of dholl, lentils or beans on days for which 60 grammes of tripe are appointed and 30 grammes on days for which 75 grammes of tripe are appointed.

(5) Snook or Cod (petite morue rouge) or Ling (morue blanche) or Poisson des Iles (weight being increased by 40%).

(6) At the discretion of the Medical Officer, maize may be substituted for rice at the rate of 9 grammes of maize to 10 grammes of rice.

(7) Dholl is to be issued on 4 days a week, lentils on two days, and beans on one day.

§ Tripe shall be issued on Mondays, Wednesdays and Saturdays and Salt fish on Tuesdays Thursdays, Fridays and Sundays.

* Leaves of *Solanum nigrum*.

QUARANTINE.

Quarantine.

There are two quarantine stations, one in Mauritius, one at Flat Island, a place some 20 miles distant from Port Louis and 6 miles off the northern end of the Colony.

Disinfecting station, Port Louis Harbour.

In addition, there is a small inspection and disinfecting station fronting the harbour. Here the two steam disinfectors are housed, and there are suitable rooms for examination and facilities for washing. I found the place clean and in good order. It had not been used for some time, but I was told it had been found useful on many occasions.

Quarantine station, Canonniers Point.

The quarantine station in Mauritius is situated on the coast at Canonniers Point in Pamplemousses, where that district adjoins Rivière du Rempart. It is accessible from the sea at least for small craft, but the railway does not pass near it. There is a considerable area of enclosed land and the buildings are, generally speaking, satisfactory. The hospital, indeed, is quite a good edifice, well lighted and with ventilation under the eaves. I found, however, that there were no latrines for the third-class quarters. These should, of course, be provided, as should a laundry, an incinerator and a disinfector. Mention has already been made of the unsatisfactory arrangements as regards water supply, and it only remains to say that the station requires more efficient supervision and that the arrangements for preventing persons under quarantine taking French leave, either by boat or on the land side must be improved. I have suggested that if a barbed wire entanglement of military type replaced the existing single fence and was also run along the sea-side of the camp it would be easier to prevent persons playing truant. There need only be three gaps in the wire, one at the main entrance, one opposite the bathing stage and one opposite the landing place. It should be possible to guard these efficiently, though I admit that in a place like Mauritius it is not easy to enforce rigorous quarantine.

As a matter of fact, it should not often be required if the Medical and Sanitary Department is brought up-to-date and antiquated measures discarded.

Quarantine station, Flat Island.

Flat Island, which is by no means well-named and which is a lighthouse station, has an area of 626 acres. The soil is sandy and covered with grass. Filao trees have been planted and now form extensive groves on one side of the island. The latter is famed for its climate, and certainly the dry soil, the resinous odour from the filaos and the sea breezes by which it is swept suggest that it would be a suitable spot for a sanatorium. A considerable number of donkeys are bred upon the island, which, thanks to the kindness of Sir Hesketh Bell, I was able to visit.

The quarantine station was established in the late fifties of the last century, and was intended to deal with cholera and small-pox. It consists of first, second and third-class quarters, which are all separate, the first-class quarters being in a different part of the island to the others. The lay-out is good, but some of the buildings in the third-class quarters have become ruinous. The type of accommodation for third-class passengers is shown in Figs. 127, 128. There is a rain water supply closely resembling that at Canonniers Point. It is derived from the roofs. The first washings should be rejected and pumps affixed to the underground storage tanks.

Information was furnished regarding several matters requiring attention.

The most important point, if the Island is to be retained as a quarantine station, is to rebuild the stone jetty which was washed away by a cyclone. This is essential for the safe and convenient landing of stores and passengers. At present it is usually necessary to transfer from a steamer into a sailing boat under the lee of the island and then to sail round its southern face, often over a rough sea, to a gap in the reef which leads to a lagoon, and so to a sandy, shelving beach on its eastern side.

This would be an awkward matter in the case of any serious emergency and there should be no great difficulty in constructing a proper landing place on the site previously selected. The cost should not be very great, but the question of expense raises the subject of the retention of Flat Island as a quarantine station. Is it necessary, and if so should Canonniers Point also be retained?

It is not easy, with limited local experience, to pronounce upon these questions. Views as regards quarantine have greatly changed since the days when the station on Flat Island was established, but the conditions in Mauritius are exceptional and the psychology and prejudices of its inhabitants must be taken into account.

Retention of both stations.

Hence it appears wiser to recommend that both stations be retained, especially as a good deal has been spent upon them and the cost of upkeep and of equipping them fully would not be very heavy. As a matter of fact, Canonniers Point is now used as a " campment " for officials during holiday periods or as a place for recuperating after illness and thus yields a certain return from rents. It may be regarded as a subsidiary quarantine station for, in bad weather, it may be impossible to tranship passengers and stores from large steamers to small craft even on the west side of Flat Island. Mauritius has always been backward in its views as regards quarantine and has imposed quite unnecessary restrictions on shipping. The Quarantine Ordinance of 1913 somewhat improved matters, but it would be well if the Government agreed to conform to the Paris International Sanitary Convention.

Mauritius out of date as regards quarantine.

Quarantine of dogs in relation to rabies.

Quarantine may be imposed upon suspected and infected animals under the provisions of the Animal Diseases (Consolidation) Ordinance, 1915, but, as pointed out under "Rabies," the regulations are not quite satisfactory as regards dogs, which may be in the incubation stage of hydrophobia. At present, everything is left to the discretion of the inspecting Veterinary Surgeon, whereas all dogs imported into the Island should undergo a definite period of quarantine, say, for six months, as in England.

SANITARY LAW.

Sanitary Laws.

Mauritius is well supplied with sanitary laws and regulations, but unfortunately many of them are somewhat out-of-date and, as a rule, most of them are as much honoured in the breach as in the observance. After a preliminary study of the various Ordinances it appeared advisable to recommend the Mauritian Government to obtain, as soon as possible, copies of the most recent sanitary legal enactments from the Union of South Africa, Kenya Colony, Uganda, and the Anglo-Egyptian Sudan, together with the Model Conditions issued by the Egyptian Public Health Department and the Quarantine Regulations in force in the Australian Commonwealth and the Anglo-Egyptian Sudan.

These were all received in due course and were found most useful when action was taken on a suggestion made to the effect that a Consolidated Public Health Act should be framed.

I found that original ordinances had been amended again and again, and that there were scores of regulations which it was not always easy to obtain. Moreover, matters affecting the Public Health were dealt with under laws which, so far as their titles were concerned, did not indicate their association with such subjects.

Consolidated Public Health Ordinance.

The Hon. H. W. Prichard, the Acting Procureur-General, undertook a revision of the existing laws concerned in any way with public health questions. This was no easy task. Naturally, it took some time and so, prior to leaving, it was only possible for me to have one interview with Mr. Prichard and Mr. Fouquereaux, who was assisting him, on the question of the new Consolidated Public Health Ordinance, which, however, had made considerable progress. Dr. Gilchrist was present, and is now acting as adviser from the standpoint of the sanitarian.

This Ordinance, when completed, will greatly facilitate sanitary administration. The Medical Officers of Health and Sanitary Inspectors will be in a position to see at once under which section they can take action. In the past, the very existence of certain regulations was unknown to Sanitary Wardens and Inspectors, and many, not having been published for distribution, were inaccessible to them. I had complete lists prepared for the guidance of the future Director of the Medical and Health Department and for this purpose the Colonial Secretary kindly provided me with an extra typist.

Owing to lack of time one was unable to give much advice regarding the amendment of sanitary enactments but, with the help of Dr. Gilchrist, I revised the existing milk regulations which are always amongst the most difficult to frame in a satisfactory manner.

The numerous changes which had to be made indicate how rapidly sanitary science and practice advances and how necessary it is that the laws governing the latter should keep pace with the progress made.

REORGANISATION OF THE MEDICAL AND HEALTH DEPARTMENT.

Reorganisation of the Medical and Health Department.

Having now passed in review the chief medical and surgical problems with which Mauritius is confronted and indicated, so far as I am able, the measures which should be adopted for their solution, it is necessary to consider the administrative machinery required for carrying out the work in an efficient manner. The consideration of this question formed indeed one of my principal terms of reference. I went fully into the matter while in Mauritius and in interim report No. 8 outlined a scheme for the reorganisation of the Medical and Sanitary Department on what I believed to be sound and essential lines.

New schemes

This scheme is here reproduced but further details are given and it has been thought advisable to prepare two graphs, the one showing the administrative situation which existed at the time of my arrival in the Colony and the other demonstrating that which will obtain if my proposals are carried into effect. Only posts held, or to be held, by professional members of the Staff are shown. (See Graph A.)

Graph A.

MEDICAL AND HEALTH DEPARTMENT.

ORGANISATION EXISTING IN APRIL, 1921.

Director—(£933 0s. 8d.—£1,000) Vacant (Dr. Momplé acting).

SANITARY DEPARTMENT.

Chief Sanitary Officer and Malaria Authority—(£600—£666 13s. 4d.) Vacant (Dr. Castel acting).

- Sanitary Warden (£606 13s. 4d.) Port Louis District (excluding City), Pamplemousses, Rivière du Rempart, Flacq, Moka
  Dr. Castel (also acting as Chief Sanitary Officer and Malaria Authority)
- Port M.O., Port Louis (£180) Vacant (Dr. Keisler acting)
- Sanitary Warden (£606 13s. 4d.) Port Louis (Urban), Black River District, Dr. Keisler (also acting Port M.O., Port Louis)
- Sanitary Warden (£606 13s. 4d.) Pl. Wilhems, Grand Port, Savanne (Dr. Masson on leave), Dr. Chauvin acting

Bacteriological Laboratory.

Superintendent (£666 13s. 4d.—£800) Dr. Barbeau (also acting Govt. M.O. Pl. Wilhems and medical referee)
Mr. Maya, Assistant (Non-medical)

MEDICAL DEPARTMENT.

- Civil Hospital, P. Louis (£600)
  Med. Supt. (£666 13s. 4d.) Dr. Rouget
  Resident M.O. (£433 0s. 0d.) Dr. Seneque
- Barkly Asylum, Beau Bassin
- Lunatic Asylum, Beau Bassin
  - Med. Supt. (£666 13s. 4d.—£733 6s. 8d.) Vacant. Dr. Portal (acting as Med. Supt.)
    Assistant Med. Supt. (£346 13s. 4d.)
    M.O. (part time) Dr. Celestin
- Govt. M.O.'s (whole time)
  1 Black River, Dr. Chasteauneuf £520
  2 Savanne, Dr. Sinnatambou £520
  3 Grand Port, Dr. Boucherville £520
  4 Pl. Wilhems, Dr. Bour (Dr. Barbeau acting) £520
  5 Pamplemousses, Dr. Boudou £433 6s. 8d.
  6 Moka, Dr. Leclézio on leave (Dr. Vinson acting) £312
  7 Flacq, Vacant (Dr. Lamberty provisional) £520
  8 Rivière du Rempart, Dr. Piarroux (provisional) £200
- Assistant Govt. M.O.'s (part time)
  1 Black River, Dr. Harel (Snr.) £156
  2 Grand Port, Dr. Guerin £208
  3 Pl. Wilhems, Dr. de Chazal £130
- Dispensary M.O.'s
  Port Louis and Police and Prison Surgeon, Dr. David £730
  Grand Gaube and Grand Bay, Dr. Harel (Jnr.) £100
  Trou d'Eau Douce, Dr. du Verge £86 13s. 4d.

Organisation in April, 1921.

The arrangements demonstrated by this graph have already been made the subject of comment both as regards the actual number of posts and the salaries attached to them which amount in all to £10,673 *per annum.* The salaries shown on the graph are stated in pounds sterling, on a basis of Rs. 15 to the pound and are the *official* salaries attached to the posts, not, at least in certain cases, those which the medical officers were actually receiving. In a great many instances they were in receipt of allowances for other duties which they were performing. Thus some had allowances for dispensary work, others for acting as Medical Referees, others for police and prison duties, others for serving as Commissioners in Lunacy while some were in receipt of vaccination fees. The whole financial system was unsatisfactory as is any system in which allowances figure largely, especially if these are of a temporary nature but the arrangement was governed by expediency and has been devised to meet a very difficult situation. I am of opinion that some credit is due to Dr. Momplé who, though grossly overworked, poorly paid, in an anomalous position and in bad health had at least succeeded in holding the service together and carrying on in some fashion.

His own views were sound and he had made representations which, owing to war conditions and for other reasons had failed of their purpose. My proposals as regards the professional Staff for the reorganised Medical and Health Department are as follows:—

Director.

Assistant Director.

There will be a Director of the Department who will be his own Chief Sanitary Officer and who will carry out the usual duties of his office but without the burden of paper work which at present makes inspection well nigh impossible. Under him there will be an Assistant Director whose duties will be largely of a secretarial nature and who will also have under his immediate charge the hospitals, dispensaries and purely medical work.

Deputy Director.

The Medical Officer of Health of Port Louis will act as Deputy Director of the Department.

Malaria Officer.

A special Malaria Officer will be appointed for the whole Island outside the two urban areas. He will have his own office and clerk, but will, of course, be subject to the Director. Attached to him there will be a land-surveyor for necessary work in major anti-malaria operations.

Port Health Officer, Port Louis, and Medical Inspector of Schools.

The shipping of Port Louis will be looked after by a Port Health Officer, who will combine with his port duties the medical inspection of children in the Port Louis schools.

Sanitary Engineer.

A Sanitary Engineer will be attached to the Department and will be available for all engineering works, both major and minor.

Medical Officer of Health, Port Louis.

Medical Officer of Health, Curepipe and Beau Bassin.

District Medical Officers of Health.

There will, as stated and as already obtains, be a Medical Officer of Health for the Port Louis District acting under the Director of the Department. There will be a Medical Officer of Health for the Curepipe-Beau Bassin Urban Area. There will be four District Medical Officers of Health disposed as mentioned in my sanitary reports. Their duties will be purely sanitary, save that they will also be responsible for the medical inspection of schools in their respective areas. In these areas they will reside.

Medical Superintendents of Hospitals.

Pathologist.

There will be, as at present, a Medical Superintendent of the Civil Hospital, Port Louis, and there will be a Medical Superintendent of the Victoria Hospital, Candos. A Pathologist should be attached to the former hospital and might be available for the latter.

Provincial Medical Officers.

There will be a certain number of Provincial Medical Officers, who will reside in their districts and who will have two or more Government Hospitals under their supervision. They will act as Visiting and Consultant Medical Officers to these hospitals and, in addition, will supervise the dispensaries and be responsible for the poor law work, the police work and any prison work there may be in their areas. They will also grant death certificates and examine and certify lunatics. Some at least of the vaccination work is very important, for I am informed on good authority that a considerable number of Mahomedans evade the law every year and that there is quite a number of unvaccinated persons in Mauritius. This question requires thorough investigation.

Vaccination work.

Enquiry necessary.

Number and allocation of Provincial Medical Officers.

I would recommend that four Provincial Medical Officers be appointed. One, despite the term "Provincial," would have charge of the Port Louis District, the Plaines Wilhems District and the Black River District. This may seem a large area, but a little consideration will show why I think these three districts may be combined. There is no hospital in the Black River District and the large hospitals in the Port Louis and Plaines Wilhems Districts will be under Medical Superintendents, so that the only hospital work the Provincial Medical Officer will have under his charge will be that in connection with the prisons in Port Louis and Beau Bassin.

He will, however, have a considerable number of dispensaries to supervise and a good deal of vaccination, certification, poor-law and police work, so that he will be kept fully employed, even though his duties will be slightly different to those of his confrères.

As regards the latter one would be in charge of Grand Port and Savanne, one would look after Rivière du Rempart and Flacq, and the third would be responsible for Moka and Pamplemousses.

Resident Medical Officers in Hospitals.

Dispensary Medical Officers.

In each government hospital, the smallest of which has 40 beds, there will be at least one Resident Medical Officer, who will either be an Indian, with experience of microscopic work, or, if available, a Mauritian Doctor who has been trained in clinical microscopy and has been certified to be competent therein. For each group of Dispensaries there will be an Indian Medical Officer, who will work under the Provincial Medical Officers, and who will, in addition to seeing patients at the dispensaries, carry out domiciliary visits in the localities served by the dispensaries. These visits will be limited to the sick poor, to whom medicines and dressings will be supplied, and who will have the benefit of microscopic examination on the spot. It is probable that it will be found convenient to place a certain amount of vaccination work in the hands of these dispensary doctors. Special arrangements may have to be made as regards the dispensaries in the two urban areas. There will be a Medical Superintendent with expert knowledge in charge of the new leper asylum at Powder Mills.

Medical Superintendent of Leper Asylum, Powder Mills.

Medical Superintendent of Lunatic Asylum.

A Medical Superintendent, trained in lunacy work will take charge of the Lunatic Asylum, Beau Bassin. There will be two Medical Officers earmarked for epidemic work and attached to the Head Office.

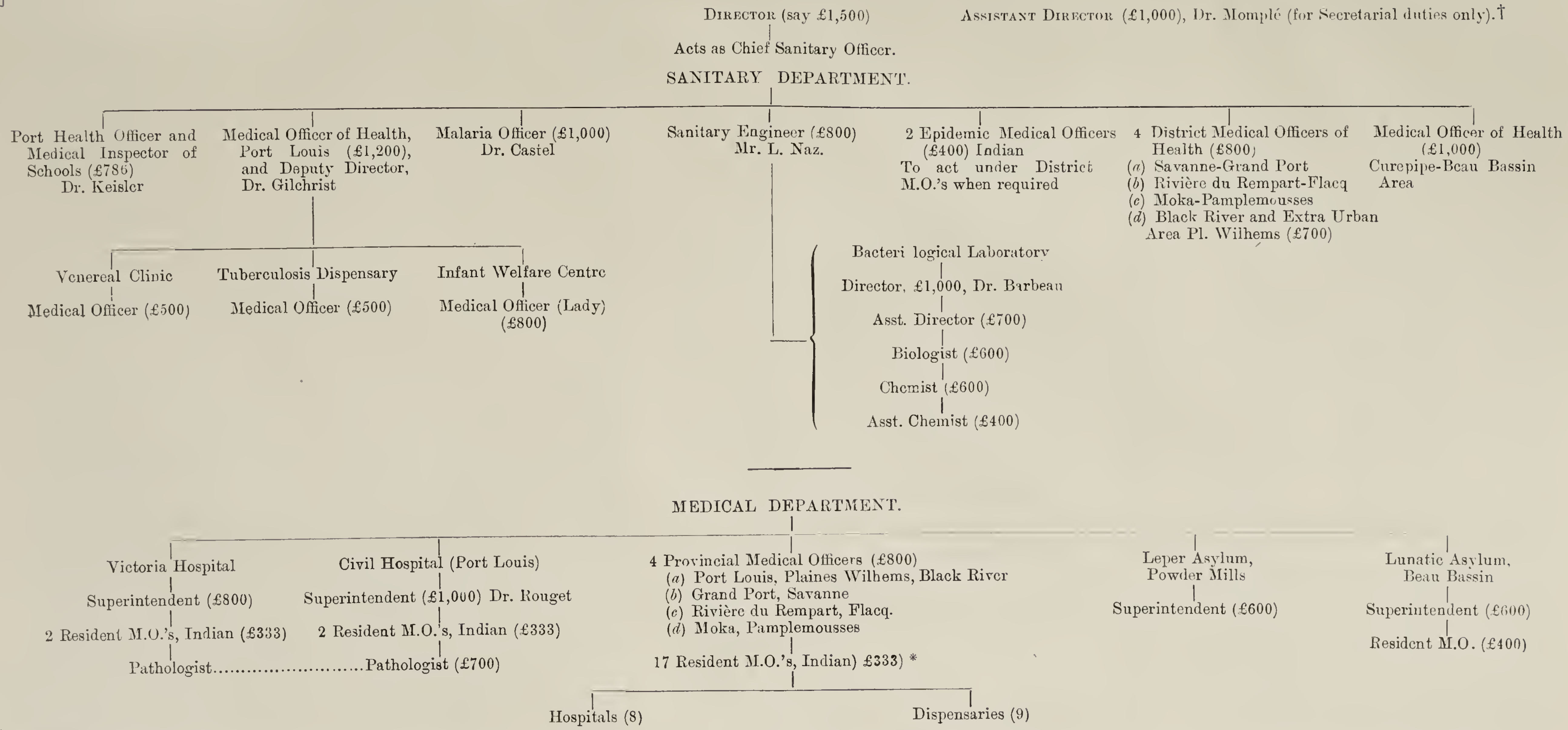
Epidemic Medical Officers.

They will, under ordinary conditions, be employed in the campaign against ankylostomiasis, but will be available for any duties the Director of the Department may allot to them. This will, to some extent, permit of the temporary replacement of men who are sick or on leave, and it will also tend to prevent the constant shifting of men, which is very undesirable.

Graph B will make it easier to grasp the details of the scheme which I admit is far-reaching, but which I also submit is required.

GRAPH B.

SUGGESTED ORGANISATION OF MEDICAL AND HEALTH DEPARTMENT.



DIRECTOR (say £1,500)

Acts as Chief Sanitary Officer.

ASSISTANT DIRECTOR (£1,000), Dr. Momplé (for Secretarial duties only).†

SANITARY DEPARTMENT.

Port Health Officer and Medical Inspector of Schools (£786)
Dr. Keisler

Medical Officer of Health, Port Louis (£1,200), and Deputy Director,
Dr. Gilchrist

- Venereal Clinic
  - Medical Officer (£500)
- Tuberculosis Dispensary
  - Medical Officer (£500)
- Infant Welfare Centre
  - Medical Officer (Lady) (£800)

Malaria Officer (£1,000)
Dr. Castel

Sanitary Engineer (£800)
Mr. L. Naz.

Bacteriological Laboratory

Director, £1,000, Dr. Barbeau

Asst. Director (£700)

Biologist (£600)

Chemist (£600)

Asst. Chemist (£400)

2 Epidemic Medical Officers (£400) Indian
To act under District M.O.'s when required

4 District Medical Officers of Health (£800)
(*a*) Savanne-Grand Port
(*b*) Rivière du Rempart-Flacq
(*c*) Moka-Pamplemousses
(*d*) Black River and Extra Urban Area Pl. Wilhems (£700)

Medical Officer of Health (£1,000)
Curepipe-Beau Bassin Area

MEDICAL DEPARTMENT.

Victoria Hospital

Superintendent (£800)

2 Resident M.O.'s, Indian (£333)

Pathologist........................Pathologist (£700)

Civil Hospital (Port Louis)

Superintendent (£1,000) Dr. Rouget

2 Resident M.O.'s, Indian (£333)

4 Provincial Medical Officers (£800)
(*a*) Port Louis, Plaines Wilhems, Black River
(*b*) Grand Port, Savanne
(*c*) Rivière du Rempart, Flacq.
(*d*) Moka, Pamplemousses

17 Resident M.O.'s, Indian) £333) *

- Hospitals (8)
- Dispensaries (9)

Leper Asylum, Powder Mills

Superintendent (£600)

Lunatic Asylum, Beau Bassin

Superintendent (£600)

Resident M.O. (£400)

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* If some of these posts are held by Mauritian Doctors they would receive the same pay as at present but would, of course, be given suitable quarters and would be relieved of all their other work. In a good many cases it is not at present possible to indicate the appropriate salary. Much will depend on the type of man available and whether he is a Mauritian or an Indian Medical Officer.

† In the case of the Medical Department, it is proposed that this officer should also have certain executive duties, such as inspection of hospitals, dispensaries, clinics and schools.

Type of man required for post of Director.

The most important post is, of course, that of the Director of the Department. There can be no doubt that the present situation is in large measure due to the fact that the type of man occupying this position in recent years has been unsuitable. It requires an official of quite exceptional administrative ability with an extensive knowledge of tropical medicine and hygiene, specially well versed in tropical sanitation, fully conversant with the literature and endowed with tact, sympathy, energy and perseverance. I fear it may not be easy to fill the post unless it is made sufficiently attractive though there is no doubt it offers great opportunities for doing good work and for benefiting humanity. It is undoubtedly a difficult situation, and whoever is appointed will require strong Government support and must be capable of impressing his personality not only on the Government officials but on all with whom he comes in contact. No appointment has yet been made but the matter is receiving careful consideration.([1])

Under the above arrangement no private practice would be allowed and, as noted, Provincial Medical Officers and District Medical Officers of Health would live, as a rule, in their districts, some of which are markedly unhealthy.

The Provincial Medical Officers would be recruited from the Mauritian doctors, either those at present in Government service and considered suitable, or such private practitioners as may wish to enter the service provided they possess the necessary qualifications. An indication has already been given in the body of the report as to the type of men who should fill the other strictly medical posts. With reference to the sanitary appointments I am strongly of opinion that both the Medical Officer of Health, Port Louis District, and the Special Malaria Officer (the " Malaria Authority " of Ross) should be given as free a hand as possible. In the past there has been far too much centralisation and, as capable men will be in charge of these posts, the latter should constitute small " imperia in imperio." Hence each officer should have his own clerical staff and, in all matters not affecting the working of the Medical and Health Department as a whole, be given a large measure of independence.

This will prevent tiresome and dangerous delays and tend to much more efficient work.

The Medical Officer of Health, Port Louis should be responsible for the anti-malarial operations in his district and the special Malaria Officer for all the anti-malarial work in the Island save that in Port Louis and the Beau-Bassin-Curepipe area.

Necessity for M. O. H. possessing qualification in public health.

As regards the posts of Medical Officers of Health in the districts (see Graph B) I think every effort should be made to fill them by local men, but it is obviously desirable, indeed it is essential, that the posts should be held by persons who have made a special study of health conditions and possess a registrable qualification in hygiene, such as a degree in public health or State Medicine, or a diploma in public health or the joint diploma of tropical medicine and hygiene. If a local man without such qualification be appointed such appointment should only be made on the condition that, within a year after assuming office, he takes steps to secure such a qualification and he should only be continued in his office if he is successful in obtaining the degree or diploma.

A possible exception might be made in the case of Dr. Masson who has long acted as Sanitary Warden.

It must clearly be understood that the ordinary medical practitioner, as a rule, knows very little about public health work. It is a very special branch of medicine and requires careful study; more especially when it has to be practised under tropical conditions. A very useful qualification would be the D.T.M. and H. This would be sufficient, and in some respects would be better than the D.P.H. or a B.Sc. in Public Health. It has the advantage of requiring a shorter course of study.

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[1] Dr. T. B. Gilchrist has now been appointed to this post.

Every effort should be made to impress upon Mauritian students of medicine, now studying in Europe, the importance of securing a qualification of this kind and to young Mauritians intending to become students of medicine, there should be explained the advantages and usefulness of following the preventive side of their science. If more tangible encouragement can be afforded them so much the better.

It may be found impossible to fill the posts locally. In that case suitable qualified men must be obtained from elsewhere. They should have had experience of the tropics and more especially of Indian conditions of life.

Facilities for inspection.

The Medical Officers of Health should be given facilities for getting about their districts by motor car. Each should have an office with, attached to it, a small room where microscopic work can be carried out. A limited, but comprehensive, library should be provided in each instance, and there should be adequate clerical assistance. It may be thought that I am asking too much, especially considering what has obtained in the past. The history of that past is perhaps sufficient argument in itself for the need of a larger staff and much more intensive work, but it may be well to consider for a moment what the scheme really represents so far as the districts are concerned.

1. *Savanne and Grand Port.*—Their joint total population is 83,183 spread over a wide area.

2. *Rivière du Rempart and Flacq.*—Their joint total population, also spread over a wide area, is 85,158.

3. *Moka and Pamplemousses.*—Their joint total population, also widely scattered, is 67,358.

4. *Black River and Extra-Urban Area Plaines Wilhems.*—Their joint population is only about 30,000, and it is more concentrated in some ways, but, on the other hand, Black River District is notoriously unhealthy, and it is important that the area bordering on the residential townships of Plaines Wilhems be carefully watched.

Need for an adequate and efficient public health staff.

Hence, considering the population to be served, and the amount of preventable disease to be combated, I do not think the proposals advanced can be considered in any way extravagant. I am absolutely convinced of their necessity and of the futility of attempting to improve matters unless an adequate and efficient staff is provided. I would be inclined to regard the first three posts as senior appointments carrying respectively initial salaries of £800 (Rs. 12,000) per annum. The Medical Officer of Health for Black River District and the Extra-Urban Area of Plaines Wilhems should, I think, receive £700 (Rs. 10,500) per annum. As already stated the Medical Officer of Health for Beau-Bassin-Curepipe, who will be qualified in hygiene, should receive not less than £800 (Rs. 12,000), preferably £1,000 per annum, and a similar salary of £800 should be paid the Sanitary Engineer.

Medical Officer of Health, Beau Bassin-Curepipe, and his duties.

The duties of the Medical Officer of Health, Beau Bassin-Curepipe, who should be a Government official, would comprise the charge of all the conservancy and scavenging work, including the cleaning of drains and gutters. He would be responsible for anti-mosquito and anti-malarial works within his district save such as require to be carried out by the Department of Public Works. He and his assistants would conduct all sanitary inspections, deal with cases of communicable disease, organise a campaign against vermin of all kinds, and arrange for disinfection. He would undertake systematic school inspections, and pass the plans of houses and other premises submitted to him for sanitary approval, a most important part of his duties. He would, through his Chief, advise the various local Boards on any matters connected with public health coming under their cognisance, and he would be in charge of any infectious diseases hospitals which may be established in his district. He would not be responsible for the Mare-aux-Vacoas water supply, but would take action as regards leaking taps, fountains, pipes and mains and with reference to other sources of water supply. He would compile the health statistics of his district, and issue an annual report upon its sanitary condition. He would be in charge of any anti-tuberculosis scheme which may be adopted and have control of measures devised for infant welfare and for the improvement of Indian villages in his area.

Duties of Local Boards.

In fact he would carry out all the varied and onerous duties which now fall to the share of a Medical Officer of Health in a populous district. The markets, slaughter-houses, cemeteries, upkeep of roads, streets, footpaths, drains, gutters, canals and streams would remain in the hands of the local Boards, together with structural work in connection with premises and buildings. This would leave in the hands of the Board all sources of revenue but the Medical Officer of Health would, of course, have powers of inspection and, after due notification, would himself carry out or have carried out such necessary works as the Boards refused to perform and yet which were manifestly their duty. In this way, I trust, that a much more active and effective administration will be obtained. The Medical Officer of Health should also deliver lectures in his district and circulate information of general interest on public health matters, endeavouring by every means in his power to carry all classes of the population with him in such reforms as it may be necessary to inaugurate. Everything depends on the type of man secured, hence the necessity for the introduction of fresh blood and new ideas.

Dentistry.

Although in Graph B there is no entry relating to Dentistry, mention has been made of the fact that one of the duties of the School Medical Officers and of the District Medical Officers of Health will be to report on the state of school-children's teeth.

Apart from this very necessary work it would certainly be desirable that a Dental Surgeon should be at the call of the Medical and Health Department. It may be possible to make an arrangement with a local practitioner and, with the information available, I did not feel justified in recommending any definite line of action, but the matter is mentioned here so that it may be borne in mind. It is of considerable importance in connection with the health and well-being of Government officials and employees and in other Colonies arrangements have been made to secure the services of Dental Surgeons for those in Government employ.

Salaries.

The total salaries amount to the large figure of £30,679 annually, an increase of £20,000 on the present emoluments. It must, however, be remembered that we are dealing with emergency conditions, and further that to some extent the amounts mentioned are maxima.

In certain cases the salary stated has been chosen with a view to secure adequate pay for an official who has rendered long and valuable service. For example, there is the case of Dr. Rouget, the Superintendent of the Civil Hospital, Port Louis. The post itself might possibly, with reason carry a salary of £800 but this, in my opinion, would be wholly inadequate remuneration for the present holder.

Again it may be possible to secure suitable men for some of the posts at lower figures, though this I greatly doubt. The cost of living has increased in Mauritius as elsewhere, and to get really good men the pay must be sufficient. It is far cheaper in the long run to make the service so attractive that it becomes efficient. At present much of the money expended is to a large extent wasted, for results commensurate, even with the comparatively poor salaries paid, are not forthcoming.

I believe that, if the full scheme is adopted there will in a few years be such a change that it will be possible to cut down the establishment in certain directions. The Indian appointments, at least so far as hospitals and dispensaries are concerned, are to hold good only for three years.

A comparison of the other salaries with those paid to medical officers elsewhere will show that they are by no means excessive. Indeed in some instances they are, I feel, below the mark, but realising the burden of expense which the Colony must bear, I have endeavoured not to lose sight of the necessity for economy.

Unfortunately the above by no means represents the total expenditure on personal emoluments.

Subordinate branches of service.

The subordinate branches of the service must be considered. Taking the medical side first, I may say that in some cases it will pay to increase the salaries of hospital stewards. These men hold responsible positions, and have to deal with the contractors who supply food. They should be placed as far as possible, beyond the reach of temptation.

Dispensers.

Mention has been made of the fact, that, owing to the poor pay offered, Government has had to be content in many cases with an unsatisfactory type of dispenser. The better dispensers have drifted away to the sugar estates hospitals, where they command higher salaries. Although I collected records of all the salaries paid, lack of time prevented me going as fully into the question as I would have liked. It is one requiring careful consideration and I feel that it demands more knowledge of local conditions than I possess. It can only be correctly gauged by the new Director of the Department when he has gained sufficient experience. Hence I feel it is better to make no definite pronouncement.

I was able, however, to gain a better idea of the conditions obtaining on the sanitary side with which also I find myself more competent to deal while, in some ways, it is the more important.

Qualified Sanitary Inspectors.

In the first place I was soon convinced that it was absolutely necessary to introduce a small number of qualified Sanitary Inspectors of the class which have rendered such good service in other British Colonies and in the Anglo-Egyptian Sudan. Accordingly at an early date I pressed for the appointment of four qualified Sanitary Inspectors for Port Louis. This was not a new recommendation. Long ago Osbert Chadwick, a sanitarian certainly in advance of his time, advocated the same measure and even cited, as I did, the fact that the men required are those who have passed the examinations either of the Royal Sanitary Institute or of the Sanitary Association of Scotland. It is now possible to obtain—what scarcely existed in Chadwick's time—men holding these qualifications and with tropical experience.

Four inspectors for Port Louis.

Of the four Inspectors for Port Louis one would function as Chief Inspector, and he should certainly have seen service in the tropics.

After consultation with the Colonial Secretary, I suggested that his initial salary should be £450 per annum rising to a maximum of £550 by increments of £25 every 2 years. For the other three inspectors salaries of £400 per annum were proposed. At the latter figure a qualified sanitary inspector was, through the good offices of Dr. Gilchrist, secured in Durban. He arrived before I left Mauritius, started in a promising way and, I understand, has already proved his worth.

Two inspectors for the Five Towns.

The recommendation was also made that two qualified Sanitary Inspectors should be appointed for the five towns in the Plaines Wilhems District.

Local Sanitary Inspectors.

As regards the local Sanitary Inspectors there should be two for Savanne and three for Grand Port. One should be sufficient for Rivière du Rempart if he is given means of getting rapidly about a district not well supplied with railways, but there should certainly be two in Flacq. It is, however, possible that the former district will require two and the latter three. Much depends on what is done in the way of speeding up office work and limiting duties to what is required by the Medical and Health Department. If these matters are put on a proper footing one Inspector may be sufficient for Moka, but Pamplemousses, a difficult district, will require two. For Black River District one should suffice, and one should also be enough for the Extra-Urban area of Plaines Wilhems.

It cannot be said that the above is an adequate inspecting staff. It might be if the Inspectors were fully qualified, had good subordinates, travelled about on motor bicycles, and were all energetic and keen on their work. This is not the case at present but recommendations must be practical and it would be impracticable to attempt anything more ambitious.

The number of local inspectors required for Port Louis is a matter best left in the hands of its Medical Officer of Health.

Sanitary Guards

It is difficult to advance any definite recommendations with reference to Sanitary Guards for, as at present constituted, they are to all intents and purposes, a negligible quantity in the health campaign. They are little more then perambulating note-takers and entry-makers. Hence until proper training for them is instituted, the unfit weeded out and new blood introduced I think it wiser to refrain from suggestions. The Director of the Medical and Health Department will have to solve the question of their numbers and emoluments.

Headmen system for Indian locations.

For the Indian locations it would be a good plan to introduce the Headman system. A Headman chosen by the villagers themselves as one whom they respect and trust should be appointed. It will be his duty to see that order is kept in the village and that it is maintained in a cleanly state and he will be responsible for reporting nuisances and cases of illness. The system works well in the case of peoples far less intelligent than the Indians of Mauritius and could be gradually developed if found successful.

It is true that, owing to differences in race and religion, difficulties may be encountered, but at least this method of administration merits a trial, and I do not see in what other way improvement can be effected.

Pay of local sanitary inspectors inadequate.

The rate of pay of local sanitary inspectors is undoubtedly much too low. In the case of all those whose services are worth retaining the yearly salary should not be less than £150 (Rs. 2,250). Furthermore there should be a sliding scale and it should be possible for any of these men to reach a maximum of £250 (Rs. 3,750).

Instruction for inspectors' examination course.

In no case, however, should any increase above £150 be granted until an inspector has undergone a course of special training and has passed an examination adapted to show his proficiency in hygiene as applied to Mauritius.

So far as Port Louis is concerned the instruction might well be imparted by the Chief Sanitary Inspector who, as suggested in my memorandum of April 20th, 1921, on the Sanitary Control of Port Louis, should be placed in charge of a practical Training School of Sanitation where the local Inspectors can be fully instructed in their duties.

Training School of Sanitation.

Examining Boards.

In the Beau Bassin-Curepipe area I would suggest that the Medical Officer of Health himself, should undertake the teaching, assisted, so far as practical demonstration is concerned, by one of the new inspectors. The examining Board should, I think, consist of the Director and Deputy Director, Medical and Health Department, the Special Malaria Officer, who I submit, will have to be appointed for the whole Island apart from the two large urban areas, and some other professional man possessing a degree or diploma in sanitary science. I am also of opinion that if, in the process of time, the posts held by the new, qualified sanitary inspectors become vacant local inspectors should be eligible for them, provided either that they have gained the certificate of the Royal Sanitary Institute or the Sanitary Association of Scotland or, by a course of extra study, have qualified to sit for and have passed a special advanced examination to be held in Mauritius ([1]).

Indian Sanitary Inspectors.

It would be a good thing if some of the well educated members of the Indian community found their way into the sanitary service. In India many Indians have devoted themselves to sanitary work and have written manuals of considerable merit. They would understand Indian conditions, could be most usefully employed in several directions and would be able to influence Indian opinion, and spread the Gospel of Hygiene amongst their countrymen in a way which cannot be done by others.

Training of Sanitary Inspectors and Guards.

I would only say that I think Dr. Gilchrist (who was lecturer in hygiene at the Technical College, Durban) should be asked to institute a course of instruction both for sanitary inspectors and sanitary guards. I think this matter should be pressed forward with all speed, and a sum of money set aside to provide models, diagrams, plans, etc., while arrangements should also be made for lantern demonstrations which might be attended by any interested as well as those for whom they are specially intended.

Sanitary Engineer.

If the Sanitary Engineer is appointed he should have in each district a small gang of labourers constantly at work under the supervision of the Sanitary Inspector. There will always be plenty for them to do.

District Mosquito Brigades.

Similarly there should be in each district a Mosquito Brigade. It should consist of not less than one foreman and three subordinates, all trained to recognise the water stages of the mosquito and able to petrolise and carry out minor anti-mosquito measures. These brigades should be distinct from the moustiquiers and cantonniers, who will act under the Special Malarial Officer. I think that they should be controlled by him to prevent clashing and confusion in the work, but the foremen should also report directly to the Medical Officers of Health of the Districts. To the latter the Mosquito Brigades will act therefore as intelligence agents, and they will take their orders from the special Malaria Officer. As already indicated the control of anti-mosquito and anti-malaria operations in the Port Louis District and in the Curepipe-Beau Bassin area will be vested in the Medical Officers of Health of these places.

Necessity for speedy action in health matters.

The most important requisite in the future is speedy action. The delays which occur are scarcely credible, but examples of them were given in Interim Report No. 3.

Tropical sanitation is a matter of minutes and hours, not of days, weeks or months. Elsewhere one has had to repeat this formula again and again, but in Mauritius it is necessary to add to it "or years," and this even in the case of small matters which could be put right in a few minutes. It is in truth a lotus land in matters hygienic!

A great deal of the paper work should be scrapped and should be replaced by active operations in the field. The endless petty prosecutions which waste time, spoil tempers and produce antagonism to hygienic measures, should, as far as possible, be abolished. An effort should be made to advise, instruct and help rather than to punish, but where punishment *is* necessary it should be adequate.

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[1] The Royal Sanitary Institute is, I am glad to say, prepared to make arrangements whereby candidates can present themselves for examination for its certificate in Mauritius.

Office re-organisation.

It may here be said that the whole general and clerical arrangements of the Medical and Health Department require thorough revision. I had an opportunity of inspecting them along with the Colonial Secretary, and we agreed that the system in vogue was cumbersome and antiquated. I understand that steps have been taken to remedy this state of matters.

Collection of information.

Co-operation of Bacteriological Laboratory.

The acquisition of accurate information should have a foremost place in the sanitary programme, and a serious effort should be made to collect really reliable statistics. A statistical section should form part of the annual health reports submitted by the Medical Officers of Health and careful comparisons should be instituted from year to year. Greater use should be made of the laboratory at Réduit, the resources of which must be increased to enable it to play its part in the campaign against disease and death. At present much of the diagnosis in the case of preventable disease is guesswork, while in any case rapidity of diagnosis means half the battle.

Co-operation of Medical Practitioners.

The help of medical practitioners should be enlisted and the Medical Officer of Health should keep them informed of what is happening in the way of outbreaks of disease or the occurrence of unhygienic conditions. He should also take steps to educate the public by means of posters, leaflets and general propaganda.

It would be a wise move to publish in the press a weekly or monthly list showing the notifications for infectious diseases. Such a procedure interests the general population and stimulates it to follow the results of any preventive measures which may be taken.

Bureau of Information

In order that propaganda should be effective there must be some kind of Bureau of Information, and that should be located in the Head Office of the Department. Steps have already been taken to replenish the library and bring it up-to-date, and also to secure a much larger supply of such journals and reports as are likely to be of practical value. Some useful publications arrived before I left, and Dr. Gilchrist acquired for his own use most of the books of reference which had accompanied me. The Tropical Diseases Bulletin had of course been regularly received and is a most valuable compilation. I am inclined to think it would be well if more copies were ordered so that it could be distributed to hospitals and health officers. The really keen man is likely to obtain copies for himself, but it would be well, at least in the first instance, if Government provided it free so that medical officers, unacquainted with it, may be given a chance of becoming familiar with it and of appreciating its value. The office copy might, of course, be circulated, but I do not think such an arrangement would prove at all satisfactory.

In the immediate past medical officers holding administrative posts have been so overburdened with work and subjected to such a strain that it has scarcely been possible for them to follow the literature as it should be followed. The Director of the Bacteriological Laboratory has managed to keep abreast of those sections of it having a bearing on his own work and has experienced the benefit of so doing while his department has correspondingly profited.

Lectures and demonstrations.

Study leave.

More, however, is required. There should be lectures and demonstrations, and, above all, provision should be made for Study Leave. However diligently a man may follow the literature, however assiduously he may apply himself to operative work or microscopic study in Mauritius, he will infallibly lose touch with the progress of scientific medicine, surgery and hygiene, unless he can obtain practical instruction elsewhere and get a chance of seeing what others are doing. The Departmental Committee, which reported on the Colonial Medical Services, strongly urged the necessity for study leave, and the isolated position of this Colony makes at even more important here than elsewhere. Without going into details, I would suggest that the lines suggested by the Departmental Committee be, as far as possible, followed, and also that, where it is feasible, advantage be taken of the comparative proximity of either South Africa or India where excellent facilities exist. For example, the South African Institute of Medical Research in Johannesburg and the new School of Tropical Medicine and Hygiene in Calcutta could furnish the student with well nigh everything that he could obtain in Europe, at least so far as tropical medicine, hygiene, bacteriology and pathology are concerned.

Opportunities afforded by South Africa and India.

The great hospitals in these countries could also provide him with instruction in surgery, midwifery and diseases of women and children and save him the time and expense necessary for proceeding to France or Great Britain.

BACTERIOLOGICAL LABORATORY.

Bacteriological Laboratory.

It will be noted that in the graphs the laboratory (Fig. 129) is shown as serving both the medical and sanitary branches of the Department. To my surprise I found that when the Mauritius Royal Commission of 1909 visited the Colony with a view to cutting down expenditure, owing to the serious financial crisis with which it was then faced, it actually advocated the abolition of this most essential institution. Such a decision shows how little the members of that Commission realised all that this laboratory means to Mauritius. It appears they were influenced by local medical opinion. At least Anderson in his chapter on plague in "The Epidemics of Mauritius" states, "there are some medical men in Mauritius who consider themselves authorities or experts in Plague, some of whom have only spent a limited time in a bacteriological laboratory in Europe, and have never attended a course of lectures in any School of Tropical Diseases, who decry serotherapy and anti-plague vaccination, because they were not successful with their cases, with the consequence that the Commissioners sent to Mauritius a few years ago to make retrenchments in the expenditure of the Colony have advised the suppression of the only Government laboratory extant, and the dismissal of the Director, Dr. Lafont, probably the only good bacteriologist in Mauritius, a man who has studied at the Pasteur Institute, and under the great masters of France!

"I lay stress on this deplorable mistake made by the Commissioners, to show how the Mother Country may ruin her Colonies in trying to save a few thousand pounds a year!"

All this is very true, and I do not think I have anything further to add to what was said regarding the laboratory and its work in Interim Report No. 8. The remarks are here transcribed.

Value of laboratory work.

"Anyone who knows anything about medical and sanitary science in the tropics is aware that a well-equipped bacteriological laboratory for routine and research work is an absolute necessity, and is, moreover an exceedingly valuable asset. Fortunately the laboratory at Réduit will compare favourably, save as regards size, with many laboratories in other parts of the tropics. I am of opinion that it is conducted in an efficient manner and that every effort is made to follow the literature and keep up-to-date.

Paucity of staff and space.

"It suffers, however, from lack of staff and lack of space and it is essential that some of the Improvement Fund be expended on remedying these defects. Money thus spent will soon yield a rich return, not perhaps in actual cash, but in the way of lives saved and knowledge acquired.

"I have discussed the future of the laboratory with Dr. Barbeau, and my recommendations regarding it fall under two heads :—

Additions to staff.

(1) *Staff.*—On the bacteriological side a qualified assistant is required. There should also be a Biologist to carry out protozoo-

logical and general parasitological work. He must be duly qualified but need not necessarily be a medical man. On the chemical side there is urgent need for a Chief Chemist and an Assistant Chemist, both qualified men. A junior laboratory assistant for the general work should be appointed. A clerk, who would also act as storekeeper, is a necessity. Six servants are required in place of the three now available. If it can be arranged it would be advisable that the Director should live near the laboratory, as was formerly the case.

Buildings.

(2) *Buildings.*—The existing wooden shed should be enlarged and altered so that six small laboratory rooms will be forthcoming. The estimated cost is Rs. 8,000.

" I am glad to say that representations have resulted in the provision of a typewriter, while electric light and electric power are to be supplied.

Routine work.

" It is certainly advisable that this laboratory should carry out examinations for medical practitioners free of charge. The small loss in revenue that would result is more than compensated for by the knowledge gained, and the opportunity of applying that knowledge to preventive work. In the case of Wassermann tests, however, I think it reasonable to impose a fee.

" The triple anti-typhoid-paratyphoid vaccine (T.A.B.) should, I think, be supplied in place of the single vaccine now issued. Paratyphoid infections are probably more common in Mauritius than is at present supposed.

" I have spoken of the increase of laboratory accommodation, and I have done so because Dr. Barbeau thinks, and I agree with him, that in connection with the laboratory, small scholarships might be established to enable promising students of the Royal College and the Agricultural Department to gain an insight into bacteriology and public health chemistry.

Research work.

Lines of research.

Proper reports.

" In addition, however, I would urge the value of extending invitations to research workers to visit Mauritius and endeavour to solve several of its more pressing problems. Amongst these I would mention the life history of *A. costalis* and certain anti-larval measures mentioned in my sanitary reports, the relationship, if any, of *Anopheles mauritianus* to malaria, the insect vector of surra, the snail hosts of the human schistosome, the nature and significance of rat leprosy, whether any species of mosquito, *apart from Culex fatigans*, can transmit filariasis, the causes of splenomegaly, the incidence of chlonorchiasis, the possibility of the presence of undulant fever and leishmaniasis in the Island and the nature of the common ulcerative processes. As many more, of nearly equal importance, could easily be listed. Given generous and sympathetic treatment, this laboratory can be a great power for good in the land and funds should be forthcoming to enable it to produce reports of a kind commensurate with the magnitude and value of the work to which it is devoted. It must be remembered that the efficiency of this laboratory will, in a large measure, determine the accuracy or otherwise of the medical statistics of the future. These at present are notoriously unreliable, and hence it is difficult to obtain a correct impression of the prevailing pathological conditions. It is most necessary that this state of things should be remedied, hence the urgent plea for placing the laboratory on a sound basis.

Laboratory instruction.

"Moreover the laboratory should, in the future, serve as a teaching institution. Medical Officers should be sent there for periods of training in clinical microscopy so that they may become familiar with blood examination of all kinds, with the examination of stools, urine, sputum and discharges and be able to carry out their duties efficiently.

"It is strange that in the past so little advantage has been taken of the laboratory in this direction. At the same time teaching will throw a very considerable burden on the Staff, another reason why it must be increased. I suggest that Dr. Barbeau to asked to prepare a syllabus of practical instruction and to suggest how the courses for Provincial Medical Officers, Medical Officers who may possibly act as Hospital Residents, and, if necessary, for District Medical Officer of Health also, had best be arranged."

A QUESTION OF ALLOWANCES.

A question to be considered when the reorganisation of the Medical and Health Department is undertaken refers to certain allowances for pension purposes. By Schedule B of Ordinance No. 30 of 1881, all Medical Officers in view of their professional qualifications were entitled, under certain general conditions, to the addition of 7 years to their period of service when the computation of their retiring allowances was under consideration. Allowances.

An amending Ordinance, No. 20 of 1904, abolished this privilege in the case of Medical Officers joining the service after that date, save as regards the Director and Assistant Director of the Medical and Health Department who were still allowed to benefit to the extent of 5 years and 3 years respectively. This amendment has been a cause of considerable dissatisfaction amongst those concerned who point out, it appears to me with justice, that if District Magistrates still continue on the list of beneficiaries, Medical Officers should not be excluded.

I venture to suggest that the matter be made the subject of enquiry especially at a time like the present when it is so necessary to render the service popular and attract the best men to it.

MISCELLANEOUS.

There are a few other matters which may be conveniently grouped under the above heading. Miscellaneous.

LOCAL MUSEUM OF TROPICAL MEDICINE AND HYGIENE.

I would like to suggest to wealthy and influential Mauritians that they could not serve their country better than by establishing in Port Louis a graphic museum illustrating all matters, both medical and sanitary, *as they affect Mauritius.* No subjects lend themselves so admirably to graphic representation as do tropical medicine and hygiene. A museum of the proper type can be made both artistic and highly educative while experience has shown that it possesses a great interest for the populace as anything must do which shows them, in an attractive way, conditions intimately affecting their lives and welfare. This is not work for the Government. It should be carried out for the people by the people. Such a museum would not cost a great deal, for it would consist chiefly of photographs, drawings and simple models. Much depends on how it is arranged and presented, and there exist in London and Zanzibar types which might with advantage be followed. Progress in sanitation could be demonstrated in such an exhibit, and the doubter and pessimist silenced by a display of facts. Museum of Tropical Medicine and Hygiene. Value of such a museum.

I think it must be evident from what has been said that the crying need in Mauritius is education in public health matters. Without it, so far as domestic hygiene goes, little can be accomplished, and in the tropics a great deal depends on domestic sanitation and attention to the *minutiæ* of hygiene. Take, for example, the case of plague. Unless the people can be made to understand how plague is spread and the rationale of the measures taken for its repression, they will never co-operate with the health authorities, and, without their co-operation, it is exceedingly difficult to make progress. This has been well emphasised in a recent paper by Mendelson on plague in Bangkok. It is not enough to deliver lectures and issue pamphlets. The lectures are forgotten, the pamplets are thrown aside. What is required is something permanent and graphic. It is comparatively easy to teach the children in the schools, but it is necessary to educate also the adult population, unless much valuable time is to be lost, and for an adult population like that of Mauritius nothing has the educative power of an attractive and well arranged museum, especially if there is someone to explain its teachings.

As stated in one of the interim reports, it is no use dragooning the lower class population into a sanitary method of life. They will resent such action and it will often defeat its own ends. It is true that it is necessary to apply the law and to inflict fines in some cases, but this alone will never accomplish the desired result. Hence the value of an institution such as I have indicated and which I hope may yet be established through the generosity of Mauritians who have the welfare of their country at heart.

EDUCATION OF MUNICIPAL BODIES.

Education of Municipalities and Local Boards.

In order to enable Municipalities and Local Boards to understand the principles of hygiene and to carry out the duties which should fall to their share, it would be an excellent thing, if it were only feasible, to arrange that the members of these bodies should be given an opportunity of seeing what can be done and is being done outside Mauritius. They would not need to go far away. Six days' sail from Port Louis is the new town of Lourenço Marques. There a sanitary revolution has been accomplished by the Portuguese, largely, it is true, with the assistance of British capital. In a place which, not long ago, was a noisome and malaria-producing swamp, a well-laid-out, clean and modern town has been erected, which is well-drained, well-lighted, has an excellent tramway system, good streets, fine shops, an up-to-date market, and is indeed in some ways a good example of what can be accomplished under adverse circumstances. It is perhaps too much to expect that Port Louis, in its comparative isolation, can ever become a second Lourenço Marques, but a visit to the latter would, I think, be an eye-opener to certain Mauritians who occupy responsible positions and should prove a guide and incentive to better things.

Provided an excursion of the kind suggested was properly arranged and managed, I believe it would pay the Government to provide for it with a view to instilling new ideas and engendering a healthy feeling of rivalry.

AN ASSOCIATION SUGGESTED.

Recommendation as regards relation of medical and sanitary matters in Mauritius to Advisory Committee, Colonial Office.

In order that the medical and sanitary affairs of Mauritius should be kept constantly in mind, and that every help should be afforded those responsible for them I would strongly urge that Mauritius should be included in the list of countries whose medical and sanitary affairs are brought to the notice of the Advisory Medical and Sanitary Committee for Tropical Africa, which meets monthly at the Colonial Office. It is true Mauritius is not part of Africa, but, all things considered, it is more closely in touch with Africa than with any other part of the Empire.

Association of Mauritius with Africa.

Its coloured population originally came from Africa, for the Creole was in the Colony long before the Indian entered it. Many of its features recall Africa, its principal malaria vector is an African mosquito, and it is much closer to Africa than to India or Ceylon. Moreover in its shipping communications it is in touch with several parts of Africa, and notably with areas such as Zanzibar, Kenya Colony and the Tanganyika Territory, the medical and sanitary affairs of which engage the attention of the advisory Committee. There seems, therefore, good reason for considering Mauritius as African from this point of view, and there are many reasons why it would be advisable to adopt the suggestion put forward and which I trust will receive serious consideration.

THE GENERAL IMPROVEMENT AND DEVELOPMENT FUND.

General Improvement and Development Fund.

It will be remembered that one of my chief duties was to indicate in what way this fund could be expended to the best advantage for the purpose of remedying the insanitary conditions which prevailed and improving the health of the inhabitants.

After reviewing the situation as a whole, I find this is no easy matter, for the amount of money available, large though it is, falls far short of what is required. There is so much to be done in so many directions that a sum of £5,000,000 instead of £1,000,000 would better have represented the actual requirements of the Sanitary Engineer and the Hygienist in any endeavour to cope fully with all the problems confronting them.

At the same time, His Excellency the Governor is to be congratulated on having secured so large a contribution for objects which too often, when financial considerations are concerned, have, like Cinderella, to take a place in the background. Moreover, owing to shortage of labour and the difficulty of getting work carried out, it will not be easy to spend very large sums to advantage in any short space of time.

Annual revenue.

The capital has been invested and should yield a yearly revenue somewhere in the neighbourhood of Rs. 750,000.

It would, therefore, appear that, with a few exceptions, it will not be necessary to trench to any large extent on the capital, at least for some time to come. Certainly it will be possible to meet all *immediate* expenses out of the interest. This is the line which has so far been followed.

Provisional statement.

Before leaving Mauritius I submitted a provisional statement which indicated the expenditure already incurred and approved, and gave a rough idea of how the balance might have to be spent. A copy of this memorandum, No. 267/R/130, was sent to the Colonial Office.

The estimate was designed rather to give an idea of the relative importance of the works on which it was necessary to expend the money than to be an approximately accurate computation. It will be found that it has now been altered in several directions. For one thing, it was impossible for me to indicate the requirements of the Consulting Sanitary Engineer, who was just beginning his work in the Colony, for another it was not feasible at short notice to obtain all the figures necessary for making the calculation, especially as the question of interest on invested monies of the fund required consideration. Even at this date one is handicapped by lack of sufficient information, while it is very difficult to know over what period of years some of the work is likely to be spread.

I have, however, been given the following official statement :—

Position at October 1st, 1921—

	Rs.
Approximate amount appropriated for various projects	799,539
Approximate expenditure to date ...	48,297

Total Rs. 847,836 = £56,522 8s. 0d.

After discussing the matter with Mr. E. Mansergh, who kindly gave me the benefit of his experience, I think it is better to consider *seriatim* :—

Points for consideration.

(1) The position at the end of August, 1921.
(2) The position so far as it can be ascertained at the present date (February, 1922).
(3) The relative importance of the work to be accomplished without any reference to monetary values.
(4) An estimate regarding those matters on which fairly definite information has been obtained.
(5) The future outlook so far as it can be determined.

Position at end of August, 1921.

1. At the end of August, 1921, the financial position, so far as the General Improvement and Development Fund is concerned, was approximately as follows, the figures being given for purposes of convenience both in rupees and pounds sterling :—

	Rs.
Total amount originally available ...	14,205,051
Estimated expenditure to 31/8/21—	
Expenses in connection with Dr. Balfour's visit	22,500

Balance Rs. 14,182,551 = £945,503 8s. 0d.

Expenditures locally approved.

Approval had been given for the expenditure of the following sums out of the fund, which it must be remembered was not intended solely for the furtherance of sanitation. As already stated, the amount available for this specific purpose was placed at Rs. 10,000,000 as a minimum.

	Rs.
General Expenditure.	
Agricultural College	100,000
Industrial School	40,000
Special Expenditure.	
Water Supplies :—	
Grand Port, Flacq and Moka	400,000
Plaines Wilhems	65,000
Bambous	13,500
Palma	6,500
Grand Bay	2,000
Beau Bassin—Extension ... (Mare aux Vacoas Water).	22,000
Anti-Malarial Measures.	
Repair of Terre Rouge Canal	20,000
Sluice in dam on Mesnil River	1,200
Conservancy.	
School latrines, Experimental Works	5,000
Milk Supply.	
Government Dairy, Curepipe ...	100,000
Carried forward ...	775,200

	Rs.
Brought forward ...	775,200
Administration.	
Salary, Medical Officer of Health, Port Louis(3 years)... ...	54,000
Salary, 3 Sanitary Inspectors, Port Louis (3 years)	54,000
Salary, Chemist for Water Analysis Works	1,800
Total	Rs. 885,000 = £59,000 0s. 0d.

It is necessary to comment briefly on these items. The water supply schemes, with the exception of that for Palma, had all been considered before my visit. The Plaines Wilhems Scheme which, I understand, includes an extension of Mare-aux-Vacoas water to Camp Fouquereaux, had been settled, the others formed the subject of discussion and, as stated in this report, I found myself in accord with the Director, Public Works department and the Members of Council who take a special interest in these developments. Hence, the expenditure was considered justifiable. The Grand Bay scheme will probably be merged in the co-called Vale Scheme for Rivière du Rempart. The two small anti-malarial measures formed part of my recommendations, and were of an urgent nature. The other items scarcely call for notice, but I would like to point out that I think it would be a mistake to continue expending monies from the Fund on personal emoluments.

Loan for expropriation scheme, Port Louis.

I am also strongly of opinion that if the expropriation scheme for Port Louis is approved, the money required for it should be raised by means of a loan. It is true that housing is one of the most important sanitary problems in Mauritius, but it is also true that if the General Improvement and Development Fund be to any extent devoted to its solution, there will be nothing left for other schemes.

It is little use building good houses if the water supplies remain polluted, the conservancy systems faulty, and if malaria continues unchecked. Such a policy would, it is to be feared, create mortuary chambers in the new dwellings. On the other hand, I agree with His Excellency the Governor that a reasonable amount of the Fund may well be devoted in improving housing conditions. He has, in large measure, completed his useful Cassis scheme, but is desirous of extending it in the direction of erecting suitable houses for the railway employees at Plaine Lauzun. I think this project should be encouraged, though it will absorb Rs. 150,000. Happily brickfields established by Sir Hesketh Bell, with the aid of labour he imported from Ceylon, have proved a success, and cheap and good bricks and tiles are now available. This should help matters considerably.

With the above exception, however, I think a building programme must be left out of the question so far as the Fund is concerned.

It is much to be regretted that the latter is not of such dimensions as to permit further development in this direction, save as regards the abolition of slum areas in Curepipe.

Present position.

2. *The present position.*—I cannot be certain as to all that has occurred since I left Mauritius but, so far as I can tell, the following further sums must be deducted from the Fund. The figures are only approximately correct :—

Further (travelling and clerical) expenses in connection with Dr. Balfour's visit	12,361
Expenses in connection with Mr. Mansergh's visit	51,750
Extension, Cassis Model Village ...	150,000
Total Rs.	214,111 = £14,273 7s. 0d.

I believe something has been expended on Milk Depôts at Curepipe, but I have no particulars.

I understand it is proposed also to draw upon the Fund, or rather on the interest accruing from the capital, as the latter has, I believe, not yet been touched, for the following :—

	Rs.
Motor lorries for Scavenging Service, Port Louis	8,000
Laundry, Civil Hospital, Port Louis	6,800
Water Supply, Tamarin, Black River	6,500
Improvement Works at Mahebourg Hospital	1,200
Anti-malarial works at Pointe d'Esny ...	440
Total	Rs. 22,940 = £1,529 6s. 8d.

All these items are very necessary, but whether they should all form a charge against the Fund is another matter. I do not think hospital improvements should do so. They should be defrayed out of general revenue.

Relative importance of work.

3. *Relative Importance of Work.*—This is by no means easy to decide, but it may be said, I think without fear of contradiction, that the following measures may be bracketted equal at the head of the list :—

(*a*) General anti-malarial measures (including all necessary works for Port Louis.
Completion of Sewerage System, Port Louis.
Provision of Mare-aux-Vacoas Water to Port Louis.

(*b*) Sanitation of Port Louis, including immediate improvement of night-soil and scavenging services, the purification of the existing water supply as a temporary expedient and the rectification of roads.

(*c*) Installation of water-carriage sewerage systems for the Curepipe-Beau Bassin area.

(*d*) Immediate improvement of the night-soil and scavenging services in the Curepipe-Beau Bassin area.

(*e*) Abolition of four slum areas in Curepipe.

(*f*) Improvements of milk supply and establishment of milk depôts.
Provision of field laundries.

(*g*) Provision of steam sack disinfectors.

(*h*) Water supply scheme, Vale, Rivière du Rempart (see p. 79).
Water supply scheme, Pamplemousses (see p. 78).
Water supply schemes, Black River District (see p. 78).

(*i*) Extension, Bacteriological Laboratory, Réduit.

(*j*) Provision of microscopes for hospitals and dispensaries.

(*k*) Establishment of Laboratory for M.O.H., Port Louis.

(*l*) Model Indian Location.

(*m*) Improvements, Quarantine Station, Canonnier's Point.

The above are not by any means all the matters requiring attention, but they are those which may reasonably be considered as coming within the scope of the Improvement and Development Fund.

Co-operation with International Health Board.

It will be noted that no specific mention is made of the contribution towards soil sanitation, to which the Mauritian Government has pledged itself in agreeing to co-operate with the Rockefeller Foundation. The expenditure on improved conservancy measures and experimental school latrines is in this direction, but naturally will not go very far towards ameliorating conditions in the Colony as a whole.

Neither will the more extensive drainage schemes for Port Louis and the Curepipe - Beau Bassin area, though both are intimately connected with soil sanitation. Village sanitation, more especially in the direction of improved conservancy methods, is most important, but must, I feel, be rendered possible by the imposition of a sanitary tax.

Some of the anti-malarial measures should prove directly remunerative, for the drainage of large swampy areas will reclaim land suitable for cultivation, as has already been the case at Rivière Seche, Flacq; La Dagotière in Moka, and other places.

Consideration of various items mentioned.

It is imperative that the existing water supply of Port Louis should be purified pending the provision of Mare-aux-Vacoas water to the town, and that the faulty and dangerous conservancy system should be remedied without delay. Both these are comparatively costly schemes for which money cannot be found save from the Fund. The same is true as regards immediate improvement of conservancy in the five towns.

The abolition of the slum areas in Curepipe might possibly be made a paying proposition. Hence, it seems justifiable to devote some of the Fund to its accomplishment, especially as these areas are foci of disease in the principal residential town of the Colony, and I do not know how otherwise this most desirable improvement can be effected.

Enough has already been said to show how very necessary it is to place the milk supply on a better footing. It would probably take a quarter of a million sterling to introduce a thoroughly satisfactory scheme, and its maintenance would be most costly. Hence, I fear Mauritius will have to be content with the minor measures already indicated and rely on education, combined with legal action when necessary, to bring about a change in the situation.

The provision of field laundries is of equal importance and they should yield some return.

It appears advisable to defray the cost of the steam sack disinfectors out of the Fund. They are not expensive, and form part of the general scheme for the amelioration of the local conditions.

The hydrocyanic acid gas disinfectors, specially intended for ridding the railway carriages of vermin, should, I think, be a charge against the contingent of the Railway Department.

The minor water supply schemes may legitimately be regarded as items to be defrayed out of the Fund, but the imposition of a water-rate on those benefiting by them is indicated. Indeed all the water schemes should be placed on a sound business basis. Most of the present financial arrangements as regards the provision of water are unsatisfactory and some, as for example the pernicious "prise" system in Port Louis, are absurd.

Although the Bacteriological Laboratory figures rather far down on the list, I earnestly trust its claim will not be overlooked. It might perhaps, with good reason, be given a better place, as might the entry relating to microscopes. Both these items are placed in a comparatively lowly position merely because neither involves a heavy expenditure, and the importance of one at least has already been recognised. The Laboratory for the Medical Officer of Health, Port Louis, is in my opinion essential, and should certainly form a charge against the Fund.

The remaining items scarcely require explanation. The improvements at the Quarantine Station might perhaps more suitably be met out of general revenue. The same is true as regards the new landing stage at Flat Island (p. 116) of which, as will be seen, no mention is made.

Partial estimate

4. *Partial Estimate.*—The only figures, apart from those already mentioned, which can, with any advantage and any degree of accuracy, be stated are as follows :—

	Rs.
General anti-malarial measures, including all necessary works for Port Louis	4,500,000
Rectification of roads, Port Louis	420,000
Improvement Night Soil Service, Port Louis	300,000
Scavenging Service, Port Louis	100,000
Destructor, Port Louis	150,000
Laboratory for Medical Officer of Health, Port Louis	30,000
Improvement Night Soil Service, Curepipe-Beau Bassin Area	500,000
Abolition Slum Areas, Curepipe	250,000
Water Supply Scheme, Rivière du Rempart	123,000
Water Supply Scheme, Pamplemousses	10,000
Milk Depôts	50,000
Field Laundries	60,000
Extension, Bacteriological Laboratory	10,000
Provision of Microscopes for Hospitals, etc., ...	11,500
Model Indian Location	50,000
Improvement, Quarantine Station, Canonnier's Point	7,000
Steam Sack Disinfectors	9,800

Total Rs. 6,581,300 = £438,753 6s. 8d.

Future outlook as regards the Fund.

5. *Future Outlook.*—It will be seen that in the above list no estimates are furnished as regards the extensive engineering works on which Mr. Mansergh is reporting.

He tells me it is impossible at this juncture to form any definite idea on the subject, but it may be taken for granted that the two sewerage schemes for Port Louis and the five towns respectively, together with the water supply scheme (Mare-aux-Vacoas) for Port Louis, will entail an expenditure of at least three-quarters of a million sterling.

These large projects, however, cannot be executed in a short space of time. It is highly probable that at least five years will elapse from their inception before they are finished, and it is almost certain that, even so, they will require the importation of labour from India or South Africa.

It is clear that care must be taken, whatever is done, to see that a sufficiently large capital sum is always in hand to ensure their satisfactory completion.

It would be a mistake to fritter away even the interest accruing from the Fund on salaries and on small items which could almost equally well be met out of the general revenue.

There is always a danger lest a Fund of this kind be drawn upon unduly and utilised upon every emergency. A tendency in this direction is, perhaps, already visible. It is very natural, as the Mauritian Government is rightly anxious to do all it can to remedy the existing conditions, while it will be some time before the Consulting Sanitary Engineers (Messrs. James Mansergh & Sons) will be in a position to submit their recommendations and estimates.(1) It seems to me that it might be well to continue a line of action which I am informed has already been followed in some measure, *i.e.*, to reinvest yearly a certain proportion of the interest in order to maintain the capital at a satisfactory figure for, say, three years.

This does not mean that no capital should be spent. It is very probable that some capital outlay will be required, but as a safeguard the above scheme commends itself.

I have indicated, so far as I can, the order of importance of the various items which may justifiably constitute a charge on the Fund, and I think that this order should, as far as possible, be followed.

It will be seen that a large sum is allocated to general anti-malarial work. As stated in the body of the Report, I believe this sum could be materially reduced if the special scheme advocated on p. 44 is carried out and proves successful.

Some of the anti-malarial measures, such as the clearing of the Pouce and La Paix Valleys, should be put in hand at once, while there should be no difficulty in making a start on the Port Louis roads and purchasing a refuse destructor. Proper night-soil pails can also be obtained without delay, and various other matters involving immediate outlay, *followed by immediate use of the material obtained* (an important point) should receive attention.

It is not feasible to enter into minute details. The general principles have been enunciated, and it must, I feel, be left to those on the spot to make the best use possible of the money available on the lines suggested.

I fear the task will be none too easy in view of the scarcity of local labour, its inefficiency and the large amount of illness which will infallibly prevail for some considerable time. Furthermore, it seems to me that the Public Works Department will require to be very considerably strengthened if it is to bear the burden which will be thrown upon it. Doubtless, Mr. Mansergh will comment on this aspect of the case.(2)

CONCLUSION.

Conclusion.

It must, I think, be evident that it will be no easy matter to render Mauritius a healthy Island, at least within a comparatively short space of time. Doubtless, if it were possible to import a large staff of specially trained men, as was done by the Americans in the Panama Canal Zone, if the funds available were much larger than they are and if ample labour of a good class could be procured, a sanitary revolution could be accomplished in a few years.

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(1) These have now been published and the remarks in this section must be considered in the light of the statements made in the Mansergh report.

(2) He has done so, advocating the formation of a Sanitary Construction Department entirely independent of the P.W.D. though working in harmony with the latter.

Difficulties of situation.

Unfortunately, none of these desiderata are forthcoming. The trained personnel at its best will be limited, the Improvement Fund, large as it is, will not go very far and local labour at least presents a difficulty. It must also be remembered that the wave of prosperity which swept over the Colony has spent itself and that the general financial outlook is not too hopeful, though it is possible that new industries may be established to supplement or even replace in some measure that dependent on sugar.

For example, the cultivation of medicinal plants might conceivably prove a profitable undertaking.

Need for education of populace in matters hygienic.

As has been stated the Medical Department will require the co-operation and goodwill of the community and speaking generally, these will only be forthcoming when education has made considerable progress. At the same time, there can be no doubt that the community, in all its classes, is highly intelligent, much more so than many populations in the tropics which have to be initiated into the principles governing health. Certain sections of it are, however, critical and past events have not led them to view sanitary endeavour with any favour or patience. This is not surprising, but I believe the inhabitants, as a whole, are quick to recognise and appreciate any good work which is designed for their benefit even though there may be opposition owing to ignorance, prejudice and vested interests.

Hope for the future.

I see no reason to be despondent as to the future provided the proper men are appointed to carry out the recommendations made. The majority of the latter, as they apply to the different districts, have been summarised in the interim reports.

A forecast.

If only Mauritius were freed from the diseases which render it notoriously unhealthy its future might be assured. It is a marvellously fertile island, and the climate for the greater part of the year is delightful, but it has drifted into a state which is inimical, both to efficiency and industry, and has, with good reason, gained a reputation which repels those who might otherwise visit it either for purposes of commerce or pleasure.

It is true that there are other places in the British tropics where the death rate is as high and where the sanitary conditions are possibly quite as unsatisfactory. These, however, are for the most part large cities, and in any case they do not possess the natural advantages of Mauritius. It is greatly to be regretted that a spot known to Nicholas Pike, the American Consul at Port Louis in the late sixties of last century, as the "Gem of the Ocean," should have become a byword and reproach from the hygienic standpoint. I have been told by ship masters that they regard Port Louis as the filthiest port in the world. This may not be true, but it is the opinion of travelled laymen. On the voyage from Lourenço Marques, a fellow passenger who knew Mauritius well told me that he thought coffin-making must be the most profitable industry in the Colony to judge by the number of funerals seen in any one day. It is true these are greatly in evidence though, naturally, the smallness of the Island and, perhaps, the somewhat limited number of cemeteries account in some measure for the frequency with which one encounters funeral processions.

The views of laymen regarding Mauritius.

One has no wish to paint too gloomy a picture, but it is well that the view of the man in the street should be stated, especially as it is not far from the mark. Moreover, the inhabitants have become accustomed to the local conditions amongst which they have been born and bred, and many of them are not in a position to appreciate the true state of affairs or to realise how the latter impresses the visitor, even if he is not specially concerned with medical and sanitary matters.

Familiarity breeds contempt.

It is only by hard and incessant work that Mauritius can be rendered healthy, but its transformation from a disease-stricken Colony to one noted for salubrity is undoubtedly a feasible, if admittedly a difficult proposition. We know what has been done elsewhere wherever modern knowledge has been applied vigorously and along sound lines. Lessons from elsewhere.

It is a question of money, energy, co-operation, education, application of scientific principles and persistence.

Of these, perhaps, the greatest is education, and in this connection a statement may fittingly be recalled, made long ago by one of our greatest statesmen. In a certain famous speech Disraeli, when introducing the Public Health Act of 1875, delivered himself of these words :—

"A great scholar and a great wit, 300 years ago, said that, in his opinion, there was a great mistake in the Vulgate (the Latin translation of the Holy Scriptures) and that, instead of saying, 'Vanity of vanities, all is vanity,' '*Vanitas vanitatum omnia vanitas,*' the wise and witty King really said, '*Sanitas sanitatum, omnia sanitas.*' Gentlemen it is impossible to overrate the importance of the subject. After all the first consideration of a Minister should be the health of the people." Dictum of Disraeli.

I would go even further and say that, so far as Mauritius is concerned, it should be the first consideration of the people themselves.

I have the honour to be,
Sir,
Your obedient servant,
ANDREW BALFOUR.

February 15th, 1922.

Note.—I wish to acknowledge the valuable help I have received in the preparation of this Report from Lieut.-Colonel G. E. F. Stammers, O.B.E., R.A.M.C. (Ret.). Apart from the general assistance he has rendered me his knowledge of Mauritius has proved of signal service, especially in matters relating to sanitation. I should also state that it is owing to the facilities kindly afforded me by Mr. Henry S. Wellcome that it has been possible to secure the photographs illustrating this Report.—A.B.

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Appendix I.

LIST OF MEMORANDA SUBMITTED TO COLONIAL SECRETARY, MAURITIUS.

Date.	Reference.	Subject.
6/4/21	Port Louis	Central and Plaine Verte Markets.
9/4/21	,, ,,	Aerated Water Factories.
9/4/21	,, ,,	Municipal Slaughter House.
11/4/21	,, ,,	Roche Bois Sewage Factory
11/4/21	,, ,,	Western Cemetery.
11/4/21	,, ,,	Central and Plaine Verte Market (2).
16/4/21	,, ,,	Aerated Water Factories (2).
16/4/21	,, ,,	Restaurants and Eating Houses.
20/4/21	,, ,,	Public Latrines.
25/4/21	,, ,,	Bake Houses.
25/4/21	,, ,,	Restaurants and Eating Houses (2) Flore Mauricienne.
26/4/21	,, ,,	Schools.
26/4/21	,, ,,	Central Railway Station.
26/4/21	,, ,,	Sanitary Control of Port Louis.
28/4/21	,, ,,	Refuse in Custom's Yard.
29/4/21	,, ,,	Dead Cattle, Albion Dock.
30/4/21	,, ,,	Quarantine on Imported Cattle.
3/5/21	,, ,,	Sailor's Home.
5/5/21	,, ,,	"Regards."
10/5/21	,, ,,	Tobacco Plantation, Plaines Lauzun.
12/5/21	,, ,,	Slaughter House (2).
17/5/21	,, ,,	Catchment Drain, Signal Mountain.
17/5/21	,, ,,	Refuse, Harbour Front.
23/5/21	,, ,,	Roche Bois Manure.
16/6/21	,, ,,	Wholesale Grain Stores.
30/6/21	,, ,,	"Regards" (2).
8/9/21	,, ,,	Control of Wharves.
22/9/21	,, ,,	Night Soil Pails.
16/8/21	,, ,,	Medical Officer of Health, Port Louis, Clerical Assistance to.
10/5/21	Plaines Wilhems	Plaines Wilhems Canal.
10/5/21	,, ,,	Metcalfe Hamlet, Beau Bassin.
14/5/21	,, ,,	Nuisance Railway Land, Beau Bassin.
14/5/21	,, ,,	Mare-Aux-Vacoas Pipe, Beau Bassin.
14/5/21	,, ,,	Railway Station Drain, Beau Bassin.
17/5/21	,, ,,	Police Station, Beau Bassin.
17/5/21	,, ,,	Indian Location, Beau Bassin.
17/5/21	,, ,,	Barkly Asylum, Beau Bassin.
17/5/21	,, ,,	Beau Bassin.
19/5/21	,, ,,	Terre Rouge Canal.
23/5/21	,, ,,	Terre Rouge Canal (2).
25/5/21	,, ,,	Rose Hill Station. Water Nuisances.
25/5/21	,, ,,	Rose Hill Station. Manure Nuisances.
6/6/21	,, ,,	St. Jean Cemetery, Quatre Bornes.
1/6/21	,, ,,	Clearance of Drain at Rose Hill and Quatre Bornes.
13/6/31	,, ,,	Rose Hill Station. Nuisances (2).
14/6/21	,, ,,	Dams Across Séche and Mesnil Rivers.
18/6/21	,, ,,	Royal College, Curepipe.
20/6/21	,, ,,	Closing of Wells, Curepipe.
30/6/21	,, ,,	Septic Tank, Lunatic Asylum, Beau Bassin.
5/8/21	,, ,,	Enteric Fever at Curepipe.
9/8/21	,, ,,	Cemetery, Curepipe.

List of Memoranda Submitted to Colonial Secretary, Mauritius—*continued.*

Date.	Reference.	Subject.
24/8/21	Plaines Wilhems	Highlands Estate.
5/9/21	,, ,,	Victoria Hospital, Candos.
9/9/21	,, ,,	Provision of Clinical Laboratory at Victoria Hospital, Candos.
17/9/21	,, ,,	Orphanages.
9/7/21	Grand Port	Mahebourg Hospital.
9/7/21	,, ,,	School, Mahebourg.
9/7/21	,, ,,	School, L'Escalier.
18/7/21	,, ,,	Hospital, Mahebourg.
30/7/21	,, ,,	Well, Old Grand Port.
21/9/21	,, ,,	Trenching Ground, Mahebourg.
6/6/21	Black River	Borrow-Pits at La Ferme.
18/8/21	,, ,,	Water Supply, Palma.
20/8/21	,, ,,	Water Nuisance, La Gaulette.
20/8/21	,, ,,	Mosquito-Proofing of Police Stations.
26/8/21	,, ,,	Trench at Military Post.
1/9/21	,, ,,	Schistosomiasis at Bambous.
28/7/21	Riv. du Rempart	Water Supply, Poudre d'Or.
1/8/21	,, ,,	Hospital, Poudre d'Or.
13/8/21	,, ,,	Hospital, Schoenfeld Estate.
21/6/21	Pamplemousses	Le Plessis Spring.
13/8/21	,,	Schoolmaster's House, Congomah.
1/9/21	,,	Wells at Triolet.
1/9/21	,,	Quarantine Station, Canonniers Point.
1/9/21	,,	Government Hospital, Long Mountain.
1/9/21	,,	Calebasses Infirmary.
1/9/21	,,	Pamplemousses Infirmary.
1/9/21	,,	Sugar Estates.
11/8/21	Moka and Grand Port	Beau Vallon and Alma Estates.
12/8/21	Moka	Pond, Beau Bois Estate.
6/8/21	Flacq	Public Fountain, Riv. Séche Village.
29/8/21	Savanne	Anti-Plague Precautions, Souillac.
1/8/21	Riv. du Rempart and Flacq	Water Supplies, Grand Gaube, Roche Noire.
22/4/21	General	Appointment of Director M. & H. Dept.
4/4/21	,,	Ordinances and Regulations.
8/4/21	,,	Model Conditions.
16/4/21	,,	Notification on Communicable Diseases.
20/4/21	,,	Rat Examination for Plague.
22/4/21	,,	Hospital Accommodation for Lepers.
23/4/21	,,	Anti-Malarial Campaign. Smoke bombs and Aspirators.
14/5/21	,,	Notifiable Diseases.
2/6/21	,,	Indian Subordinate M.O. Posts for.
7/6/21	,,	Hair Dressers' Shops.
8/6/21	,,	Maternity and Child Welfare Exh. Rep. Copies of.
13/6/21	,,	Ankylostomiasis.
13/6/21	,,	Library, Medical and Health Dept. Publications to be ordered for.
16/6/21	,,	Beri Beri.
28/6/21	,,	Indian Subordinates. (Letter to D.G.I.M.S.)
28/6/21	,,	Library, Medical and Health Dept. Journals to be ordered for.
30/6/21	,,	Library, Medical and Health Dept. Books to be ordered for.
25/7/21	,,	New Influenza Prophylactic Method.
26/7/21	,,	Assistant Chemists' Diplomas.
1/8/21	,,	Consolidated Public Health Ordinance.
6/8/21	,,	Quinine Distribution, Schools.

LIST OF MEMORANDA SUBMITTED TO COLONIAL SECRETARY, MAURITIUS—*continued.*

Date.	Reference.	Subject.
9/8/21	General	Protection Catchment Areas of Water Supplies.
9/8/21	,,	Library, Medical and Health Dept. Books to be ordered for Sanitary Inspectors.
11/8/21	,,	School Latrines.
13/8/21	,,	Cutting of Trees, River Reserves.
18/8/21	,,	Appointment School Medical Officer.
20/8/21	,,	Azolla as Anti-Anopheline Measure.
20/8/21	,,	Treatment of Influenza.
20/8/21	,,	Appointment of Sanitary Engineer.
22/8/21	,,	Town Planning.
22/8/21	,,	Conservancy in Extra-Urban Areas.
24/8/21	,,	Method of Destroying Bed-Bugs.
24/8/21	,,	Appointment of Special Malaria Officer.
26/8/21	,,	Rat-Catching Varnish.
29/8/21	,,	Medical and Sanitary Inspection of Schools.
30/8/21	,,	Appointment of Qualified Sanitary Inspectors.
5/9/21	,,	Establishment of Milk Depots.
5/9/21	,,	Sanitary Administration and Practice.
5/9/21	,,	Medical Officers of Sugar Estates.
7/9/21	,,	Anti-Plague Precautions.
8/9/21	,,	Destruction of Mosquito Larvæ.
8/9/21	,,	Hospital Libraries.
8/9/21	,,	Library, Medical and Health Department. Books to be ordered for Hospitals.
13/9/21	,,	Provision of Microscopes.
14/9/21	,,	Anti-Typhoid Inoculation.
14/9/21	,,	Mosquito Proofing of Quarters.
16/9/21	,,	Books for Medical and Health Department Library.
19/9/21	,,	Alcoholism in Mauritius.
19/9/21	,,	Field Laundries.
19/9/21	,,	Mauritius Improvement Fund, Sanitary Works.
22/9/21	,,	Appointment of Sanitary Engineer.
20/9/21	,,	Milk Regulations.
27/9/21	,,	River Reserves.
27/9/21	,,	Filter sand and Water Pipes Transport.
27/9/21	,,	Improvement and Development Fund.

Appendix II.

INTERIM REPORT OF THE DYSENTERY COMMITTEE, 1920.

Members of Committee.

DR. L. G. BARBEAU, Superintendent of the Bacteriological Laboratory (*Chairman*).

The HON. DR. E. LAURENT.
— G. GÉBERT.
GASTON ANTELME, ESQ.
DR. E. L. DE CHAZAL, M.D.

DR. W. A. EDWARDS, M.D., C.M.G.
DR. G. A. LECLÉZIO.
DR. AIMÉ LESUR.
DR. A. G. MASSON.

ALBERT THENET,
Secretary.

INTERIM REPORT OF COMMITTEE APPOINTED ON 12th OCTOBER, 1918, TO ENQUIRE INTO THE CAUSES OF THE PREVALENCE OF DYSENTERY AND ALLIED AFFECTIONS, TO MAKE RECOMMENDATIONS, AND TO SUGGEST MEASURES FOR THE REDUCTION OF SUCH DISEASES.

THE HONOURABLE THE COLONIAL SECRETARY,—

In dealing with the subject of these papers,[*] the Dysentery Committee felt that it was outside their province to enter into the administrative difficulties that may have arisen between the Medical and Health Department and the Roche Bois Manure Company. The members accordingly confined their attention to the study of the conditions attending the collection, removal and disposal of excreta in the Colony. They devoted several sittings to the consideration of these questions, and in the course of the proceedings they heard Mr. Amic, Manager of the Roche Bois Manure Company, and Mr. René de Chazal, who was kind enough to give the Committee the benefit of his experience in India. The Committee visited the factory of the Roche Bois Manure Company and inspected the arrangements recently made for a night soil service in the campments at Tombeau Bay where an epidemic of dysentery broke out in 1917.

2. From the facts they have observed and the information they have been able to gather, the Committee are satisfied that the manner in which human dejecta are dealt with in the island generally is defective at every step and favourable to the spread of excreta-borne diseases. The defects are familiar to all those who have had occasion to enquire into the matter: latrines are either non-existant or when provided are badly constructed or not used; the floors, seats and receptacles are of unsuitable materials or defective in workmanship; the seats are misused and excreta are deposited indescriminately over them and around the pails; flies are allowed free access; the pails are removed at irregular intervals, in certain cases with such delays as to create a serious nuisance, and are never properly closed; they are jostled along in miserable vehicles to and from the factory, not unfrequently spilling part of their contents on the way; as an alternative the pails are emptied (*transvasement*), several into one, on the premises, or on the roads, and placed back in the latrines without any, or only with indifferent, cleaning.

3. The manner in which the contents of the pails are dealt with at the factories is scarcely less objectionable. The mixed excreta are spread over a layer of dry sweepings in large masonry pits which are roofed over but are freely accessible to flies, dogs, pigs and poultry; the excreta are then covered over with another layer of refuse; the liquid that drains at the bottom and the pail washings are collected in open wells (*bassins à purin*) from which they are pumped up from time to time to keep the manure wet. These wells give off offensive effluvia and they constitute favourite swarming grounds for fly maggots which are found in them in countless myriads. The crude manure is then carted off or sent by rail to be used in the fields, creating no inconsiderable

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[*] M.P. 2265/19 containing suggestions from Mr. A. Amic, Manager of the Roche Bois Manure Company res: the performance of night soil service at Port Louis.

degree of nuisance in transit, and any live germ it may still contain is free to be washed into the nearest stream by the first shower. In point of fact more favourable conditions for the dissemination of such germs can with difficulty be imagined.

4. The Committee are agreed that the root of the evil is to be found in the habits of the great mass of the population; in their complete ignorance of all the essentials of hygiene and their indifference to the pollution of environments. The task before the local sanitarian is therefore a trying, but not, in the views of the Committee, a hopeless one. The intelligent co-operation of the people which is vital to success can, they believe, be gradually secured by education. To attain that object they urge that every effort should be made to promote the teaching of hygiene in schools, in diffusing the knowledge of the rules of sanitation by means of leaflets, pamphlets, lectures in the languages of the more important fractions of the community. Prizes in money or otherwise, should be offered at annual school examinations for proficiency in hygiene and every encouragement given to pioneer work in that direction. The Committee desire to point out that, in their opinion, hygiene should be taught in all schools, even private ones, including the Royal College from which will issue in the future, as in the past, most of the leading men and large employers of labour in the Colony.

5. A useful object lesson would be an exhibition by the Authorities of how things can be done well; public latrines, W.C.'s and urinals as well as the conveniences at Railway Stations, public and estate hospitals, law courts, etc., should, in the opinion of the Committee, be constructed and maintained in the most careful and irreproachable manner as examples to be followed. The Committee desire to call particular attention to the conditions created by the absence of public latrines in connection with populous agglomerations. They beg leave to insist upon the necessity for erecting model lavatories in convenient situations in all towns and villages. These constructions which should be screened from public view should receive constant attention from a specially trained staff, and separate accommodation should be provided for the two sexes.

6. With regard to the methods of excreta disposal employed in the Colony and elsewhere, the Committee regret that circumstances have not permitted of a detailed and exhaustive study of the whole question with a view to the selection of the means best adapted to local conditions. They must therefore confine themselves to general considerations. Bearing in mind that the cardinal principles are the removal as early, as completely, and at as great a distance as possible from dwelling houses of all excrementitial matters, and their final disposal in such a manner as to avoid the contamination of air, food and water, it can hardly be denied that the conditions which obtain in this Colony are very far from fulfilling the requirements of these postulates. Although the real channel of infection may still be a controverted point in many cases, yet the fact remains that the germs of numerous diseases pass out of the body with the excreta, solid or liquid, and there is every reason to believe that these germs reach new hosts as a result of direct or indirect contamination by such excreta. The marked improvement in the incidence of excreta-borne diseases that has followed the substitution of water sewerage for hand removal in many places, clearly points to the latter method as the source of some at least of the evils complained of. The Committee are therefore of opinion that the water carriage of excreta should be adopted whenever practicable for all towns and large agglomerations. They believe that with the modern methods of septic-tank and bacteria-bed purification followed by the application of the clarified effluent to land irrigation, the difficulties which militated against the adoption of this valuable sanitary measure in the past have been very materially reduced.

7. Where this method is inapplicable, the Committee regard the process of hand removal as an unavoidable evil, but at the same time they are distinctly of opinion that it can, and ought to, be modified and improved by attending to the following desiderata:—

(*a*) Latrines should be built of suitable materials, they should be well lighted and ventilated, and whenever practicable, made fly-proof.

(*b*) The wooden tubs at present in use should be replaced by impervious receptacles with a smooth inside surface and provided with tight-fitting lids. The pails supplied by Messrs. Jones Brothers & Co., Wolverhampton, and used in England and South Africa appear to meet all requirements in that respect at a reasonable cost.

(*c*) The service should be performed daily and every pail in use should invariably be replaced by a clean one.

(*d*) Substantially built motor-carts should be used for their carriage to and from the factory. This would ensure rapidity of service and a reduction of personnel.

(*e*) After being emptied of their contents, the pails should be thoroughly cleansed with a disinfectant.

(*f*) The contents of the pails, if the quantity be not too large, should preferably be destroyed by fire in a suitable furnace along with sweepings and other refuse, the heat produced being utilised, if possible, for industrial purposes. This would no doubt imply the loss of a valuable fertilising stuff, but the Committee hold that the sanitary object to be attained is of such importance as to override other considerations, and they believe that the loss will be compensated by the gain which is likely to result from a public health point of view.

8. Should it be found essential, however, to retain this material for manuring purposes or impracticable for the present to adopt another mode of disposal, the factories should be well built, enclosed and maintained; the contents of the pails should be at once mixed with a fly-repellent, such as one of the solutions of creozote oil recommended by Foreman and Graham Smith, and no manure should be allowed to leave the factories unless perfectly dry and free from fæcal odour.

9. The Committee are of course conscious that the adoption of their suggestions must lead to an increase in the cost of the sanitary services—an increase which must directly or indirectly be borne by the ratepayers. They are not blind to the fact that necessity may arise for recruiting the special labour required from India, and that compensation may have to be provided for interference with vested interests; but at the same time, they feel that such an increase of expenditure is unavoidable and must be faced sooner or later. The care of the public health is an all-important duty of the State and any progress in that direction is well worth paying for.

10. The Committee do not think they would be justified in recommending the granting of monopolies, but it rather appeals to their minds that no contractor is likely to undertake a service under conditions entailing a heavy initial outlay and recurrent expenses, unless he finds promise of recuperation and profit in the length of time his contract has to run. In this respect therefore the Committee is inclined to suggest that contracts for the night soil service (if this system is continued) be granted for periods of at least five years at a time, under stringent conditions and strict supervision. It is, however, the feeling of the members, several of whom have had practical experience of the system, that the much desired improvements to which reference has been made cannot be expected from such a system. Contractors are business men and as such—with honourable exceptions no doubt—their object must necessarily be to reduce their working expenses to a minimum. Their interests must, generally speaking, be in conflict with the public interest and the final result will remain what it is at present, *i.e.*, bad.

Sanitation is a public duty and the Committee may be pardoned if they hold that the burden of fulfilling that duty rests on the public powers, whether Governmental, municipal or rural, and the members feel very strongly that the only path likely to lead to success is for the Authorities themselves to undertake the performance of the sanitary services on the lines above laid down in the areas under their charge.

L. G. BARBEAU,
Chairman, Dysentery Committee.

21*st January*, 1920.

Appendix III.

REPORT OF THE COMMITTEE APPOINTED TO ENQUIRE INTO AND REPORT UPON THE MANAGEMENT OF RIVER RESERVES.

The Committee was appointed in view of certain difficulties which have arisen, in connection with the management of River Reserves in the Colony, with reference to the best treatment of Reserves to be adopted in connection with anti-malarial works.

2. The Committee have held eight sittings and the members have also visited a considerable number of reserves in Moka, Flacq, Plaines Wilhems and Savanne Districts. They have, further, examined the Sanitary Warden, North, Dr. L. Castel, while, in the course of their inspection, they have been accompanied by the Sanitary Wardens of the Districts visited. The Committee considers it desirable before reporting and submitting recommendations, to sketch briefly the history of River Reserves in the Colony, their management, and the opinions which prevailed, at various times, as to their utility or otherwise. It will be sufficient, for the purpose, to start with the state of matters in 1875.

3. Ordinance No. 13 of 1875 was passed to make provision for the conservation of woods and forests on the Crown Reserves and other plantations, and also to protect watercourses. It lays down that river reserves, which are the property of the owners of adjacent lands, shall be of 50, 25 and 10 feet width, in the case of rivers, rivulets and feeders, respectively (art. 1). It allows riparian owners to remove brushwood, under conditions of planting useful or ornamental trees, under the direction of the Forest Department (art. 2, para. 2). It, further, enacts that it shall be unlawful to plant reserves, except with certain trees, such as jamrosa, bois noir, fauxgayac, etc., or to cultivate any reserves except under shelter of the aforesaid trees, and in the manner prescribed by the Director of Forests. The Governor is, however, empowered to authorize, subject to conditions, the proprietors of reserves to plant, otherwise than with trees, such other portions of the said reserves as it may be found inexpedient to plant with trees (art. 6).

4. From 1875, onwards, river reserves do not appear to have attracted any special notice until malaria began to spread in an alarming degree to the higher parts of the Island heretofore practically free from the disease. The Malaria Committee, which was appointed in 1901, appears to have criticised adversely the existing conditions of the beds, banks and reserves of rivers. Certain works were actually begun, especially in the districts of Moka, Plaines Wilhems and Savanne, for the destruction of mosquito larvæ in such places. This Committee is credited with having, in its report of 1903 recommended the introduction of a Bill for the cleaning of beds and banks of rivers and streams, based on the "curage à vieux fonds et à vieux bords," of the French law on "rivières non navigables."

Articles 1, 3, and 4 of the Bill introduced in 1905 provided for the compulsory clearing of beds and banks of rivers by riparian owners. Article 6 empowered the Forest Deppartment to do at the cost of riparian owners, work left undone by them in this connection. This Bill was not, however, carried through, apparently on account of its compulsory clauses.

5. In 1906, Dr. J. Bolton, Medical Inspector, in a report (M.P. 5941/06) called attention to the high death rate on sugar estates and recommended certain anti-malarial measures. He pointed out that the reserves in the low lying parts of the Island harboured mosquitoes and caused malaria.

6. Towards the end of 1907, the Island was visited by Professor Ross, now Sir Ronald Ross, K.C.B., K.C.M.G., etc., who indicated, in his report dated 1908, the best means of combating the disease. It is of interest to recapitulate briefly his opinions and recommendations with reference to river reserves. He considered that banks of rivers should be cleared of all trees in view of malaria sanitation. Alluding to a report from Mr. Walter, then Assistant Director, Royal Alfred Observatory, he wrote that "certain large denudations of forests, which occurred in the Island some decades before, had certainly exercised a small but definite effect on the rainfall, but that the total rainfall had not markedly changed, although there had been an appreciable decrease in the number of rainy days."

Commenting upon the report of Dr. Bolton of 1906, he said that the figures adduced therein generally supported the contention made that estates with camps near river reserves had a higher death rate (due to malaria) than those where no rivers existed in the vicinity of the camps. Professor Ross was of opinion that "speaking generally the reserves are certainly dangerous. There is no doubt whatever that anophelines do breed in the streams." He concluded by saying "it, therefore, seems to me that if Government is finally driven to decide between river reserves and malaria sanitation it would do wisely to clear away the former without much hesitation." He advised the introduction of a Bill on the lines of the 1905 Bill, the compulsory clauses being replaced by permissive ones.

7. Some useful work, such as draining of marshes, the removal of noxious growth and underwood from the reserves, was then taken in hand. In a further report addressed to the Protector of Immigrants on the 12th November, 1908, Dr. Bolton regretted that, owing to the lack of provision of adequate funds, comparatively little had been done to carry out the recommendations of Professor Ross. He hinted that an immense amount of good work could be done by the Planters and a considerable amount of money saved to Government if they were allowed a freer hand. He again recommended the removal of the reserves on the banks of rivers in populous localities and in the vicinity of estate camps in the malaria zone, and said these reserves "harbour mosquitoes, pollute the water, and, in many places, are used as latrines, and have no beneficial influence on the volume of the streams and rivers they are supposed to protect." He made a formal recommendation to the effect that planters who own river reserves should be allowed to clear cut these reserves and cultivate the reclaimed land on condition that they should undertake and upkeep certain works to combat malaria on their estates.

8. This report, and all previous papers bearing on the subject (M.P. 11883/08 and others,) were referred to the Woods and Forests Board. At a meeting of the Board, held on the 9th June, 1909, Dr. Bolton and Mr. d'Emmerez de Charmoy, officer in charge of anti-malarial works, were heard. Their statements are recorded in the Board's Minutes. A report on the recommendations of Dr. Bolton, prepared by Mr. Kœnig, Director of Forests, was read. The Director also stated at the meeting "that the Forest Department does not consider that River Reserves play the part that is assigned to them. I do not believe in the influence of River Reserves on the general climate of the Island but I am sure they are of considerable interest in the question of local climate and that they influence streams, in their industrial, agricultural and other economic purposes." Dr. Bolton admitted that "River Reserves prevent erosion on the banks of rivers, diminish evaporation to a certain extent and chiefly influence favourably the volume of the stream."

9. The Woods and Forests Board, at the Meeting held on the 1st September, 1909, resolved to advise (1) the promotion of a Bill on the lines indicated by Professor Ross; (2) the continuation of the policy of the Board of authorising cleansing and scouring, and even the entire removal of river reserves on certain well defined areas in the malaria zone, in certain cases to be considered specifically on their respective merits by the Board as they occur.

The Board also advised, in furtherance of this policy, that the fullest use should be made of the permissive provisions of the proviso enacted at paragraph 2 of article 2 of Ordinance No. 13 of 1875, and of article 6 of that Ordinance; and that the owners of river reserves so situated should be authorised to cut down and destroy brushwood and plant useful trees under direction of the Director of Forests, or to make such other plantation as the needs of the particular case might require. The above recommendations were approved by Government.

10. We now come to Ordinance No. 22 of 1910 which allow riparian owners to clear under the control of the Forest Department: (1) the beds of rivers and streams, so as to ensure a regular flow of the water; (2) the banks of rivers and streams, on a width of 10 feet from the water's edge, to prevent pollution of the water and to ensure easy access to and along the edge of the river: all dead, dying, uprooted and other trees cut, and all brush and other growth removed being appropriated by the riparian owners (arts. 1 and 2). With a view to improving the sanitary condition of any locality, article 3 of the Ordinance gives power to the Governor to authorize riparian owners to destroy, remove and appropriate any tree growing in the reserves of rivers or streams. It, however, provided that no tree shall be destroyed, unless it has been marked by an authorized Forest Officer; and that all permissions granted shall be subject to conditions as to the control of the felling operation, the mode of replanting, the upkeep of the reserves, and the furnishing of security.

11. From the date of the Ordinance coming into operation, agreements, as per printed forms 6 and 7, annexed to the Minutes of Proceedings No. 3, were, with the approval of Government, entered into by the Director of Forests with riparian owners either for the management of river reserves or for the cultivation of sugar canes in these reserves, on the lines of Ordinances Nos. 13 of 1875 and 22 of 1910.

12. In the first category of agreements, in exchange for the tree or other growth removed and abandoned to them, riparian owners undertake (i) to canalize beds of rivers; (ii) to replant with trees the river reserves and to upkeep the same; (iii) to keep the beds of rivers free from weeds and obstruction and the river reserves free from noxious growth. The agreement also provides for the thinning or clear cutting by riparian owners of trees in the reserves. The right to carry out anti-malarial works under Ordinance No. 15 of 1913, hereafter noticed (§ 15), is also reserved, as well as the right of the Director of Forests or the Director of the Health Department to execute all works left undone by riparian owners. Riparian owners are, further, under the obligation of furnishing security for the execution of all the clauses of the agreement.

13. The agreements for the cultivation of sugar canes in the reserves follow the same lines and are subject to the same conditions as to (i) canalisation; (ii) obligation to keep the bed of the river and the reserves free from weeds and noxious growth; (iii) the right of either of the Directors to carry out work left undone; (iv) security. The right to carry out anti-malarial works is also reserved. The riparian owner, further, binds himself to replant the reserves with trees at any time, if the Government so directs, in case the arrangement does not give satisfaction to the Director of Forests; but this condition can only be enforced after 5 years from the date of the agreement.

14. The Director of Forests has supplied the Committee with a list of River Reserves planted with sugar canes.

This list will be found annexed to the Minutes of Proceedings.* The Director is of opinion that this system has given good results from an agricultural point of view without any cost to Government. It will be seen that the number of cane plantations in river reserves is not great. Such cases occur mostly on the littoral and below the lowest dams, as recommended, at the outset, by the Woods and Forests Board. Each case has been specifically approved by Government after obtaining the advice of the said Board, whilst still in existence, and of the Directors of the Health and Forests Departments.

The guiding principles applied were: (i) to maintain permanently under tree growth steeply sloping portions of the reserves so as to avoid the risk of erosion, and to yield up the rest to agriculture; (ii) to allow the removal of river reserves below the lowest dams where it could be shown that the sanitary condition would be improved thereby, without involving any risk of erosion.

15. There is no doubt that useful work was done under these Ordinances, without cost to the Government, but it soon became evident that malaria would only yield to a regular campaign, and Ordinance No. 15 of 1913 was passed for the execution of major and minor anti-malarial works, in connection with the river systems of the Colony.

These works include (i) the draining of marshes and low lying grounds where water accumulates; (ii) the straightening of rivers; (iii) the alteration of the levels of beds of rivers; (iv) the removal or reconstruction of dykes and dams; (v) the canalisation of river courses.

The Ordinance empowers the Governor in Executive Council to decide upon the execution of such works, both on Crown Lands and on private property, without the necessity of applying to the Supreme Court for authority. These works are to be carried out either at the cost of Government or the private owner, or of both, according as they are for the benefit of the public or of the private owner or for their joint benefit.

The Director of the Health Department has favoured the Committee with a list of the rivers, rivulets and feeders which have been canalised or roughly trained, and of the marshes drained since the passing of the above Ordinance.

This list is annexed to the Minutes of Proceedings.* It should, however, be pointed out that this Ordinance did not replace Ordinances No. 13 of 1875 and No. 22 of 1910 which still remained in force.

16. With these two sets of works proceeding simultaneously under the supervision of two separate Government Departments, administrative difficulties, from time to time, were inevitable, especially as certain opinions concerning the breeding habits of mosquitoes in streams, which were current at the time these Ordinances were enacted, have since become modified by experience.

From evidence laid before the Committee it appears that the view was originally held that the destruction of tree growth in river reserves would exercise a beneficial effect since mosquitoes would thereby be deprived of suitable breeding places, owing to the admission of increased light and air. This led to the agreements whereby riparian owners were allowed to remove the trees in the reserves and to plant sugar canes or other trees. Further experience has demonstrated, however, that this view was erroneous. It appears that the conditions created by the removal of belts of trees along the sides of rivers have proved most favourable to the development of mosquito larvæ owing to the rapid and luxurious growth of algae and other aquatic plants which takes place in water courses under the influence of the sun's rays. The upkeep of anti-malarial works is thus rendered more difficult and more expensive. Acting under this new conception, the Director of the Health Department has repeatedly protested against thinnings and fellings on the banks of rivers. He considers that no cutting of reserves or trees in Reserves should take place unless the opinion of the Health Department has been obtained, more especially where canalisation works have already been carried out and in the case of streams within a mile of hamlets or estate camps. The Director of the Health Department has also directed attention to another cause of complaint. Riparian owners who, under agreements, are entitled to clear out or thin reserves, plant sugar canes, etc., are frequently eager to reap all the benefits to be derived from such agreements, but slow in the execution of the works required to be performed by them. Hence delays have arisen which are objectionable from a sanitary point of view as the object aimed at is not attained. The Director of the Health Department also takes exception to cane plantation in too close proximity to water courses on account of possible pollution by manure.

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* Not printed.

17. The Director of Forests has explained to the Committee that thinning of the reserves consists in the removal of dead, dying, uprooted, worm-eaten and otherwise undesirable trees and of trees which bend too much over the water's surface and obstruct its flow. He considers such operations necessary for the welfare of the growing stock, combined with the replanting of vacant spaces wherever necessary. He is also of opinion that if it was necessary to consult the Health Department in all cases in which thinnings or clear cuttings were indicated delays and difficulties in the application of the law would inevitably ensue.

18. It is unnecessary to record the different cases which have arisen for discussion between the two Departments. We may, however, mention that which gave rise to the appointment of this Committee. In the case in question, the Director of the Health Department attributed the prevalence of malaria, in certain parts of Savanne, to the condition of the banks of the "Rivière de la Savanne," which had been completely denuded of trees and which were overgrown with weeds and aquatic plants, in spite of agreements entered into with planters which provide for the maintenance of the banks of the river free from such growth.

The Director of Forests stated that this denudation of the river banks was allowed in 1913 after obtaining the advice of the Woods and Forests Board.

19. After reviewing all the evidence, the Committee beg to submit the following recommendations:—

(*a*) The Committee endorses the view that the conditions created by the removal of belts of trees along the banks of rivers have proved most favourable to the development of mosquito larvæ.

(*b*) In consequence, the Committee are of opinion that the future policy of the Government, in relation to the management of River Reserves, should be directed to the maintenance of a proper degree of shade over water courses in regions where anti-malaria works are concerned.

(*c*) No tree growing in the reserves of feeders and rivulets, or within 20 feet from the water's edge, in the case of fifty feet reserves of rivers, should be allowed to be cut without the sanction and approval of the Directors of the Health and Forests Departments, more especially where canalisation works have been carried out and in the case of streams lying within a distance of one mile from villages and Estates camps.

(*d*) When thinnings of reserves take place, in this connection, only dead, dying, uprooted, worm-eaten and otherwise undesirable trees should be removed. The operation should not be a pretext for the destruction of useful trees.

(*e*) The Committee considers that behind a path, 5 feet broad, which should be maintained at the water's edge of rivers and rivulets, for the patrolling of guards, etc., there should be kept a belt of trees, 15 feet wide, consisting of 3 lines of trees, or at least a belt of 10 feet, in cases where, owing to the provisions of the law, the maintenance of a wider belt is not possible.

(*f*) In cases where rocky soil does not allow of belts of trees being established within 10 feet from the water's edge, and where the actually wooded reserves are insufficient, Government should, when possible, increase them by purchasing strips of land to form additional reserves.

(*g*) It is sound policy to carry out canalisation work up to at least half a mile, and even a mile, as the crow flies, from inhabited places.

(*h*) With a view to ensure proper control and management, all reclaimed land to be obtained from canalisation and lowering of river beds, should be surveyed by the Director of Public Works in all cases of importance and, as regards past works, such surveys should also be made where traces of the original state of affairs, existing before the works were undertaken, can be found.

(*i*) All existing agreements respecting the management of river reserves which do not give satisfaction in the above respects, should be terminated as soon as circumstances permit.

(*j*) The removal of brushwood under the condition of replanting useful or ornamental trees is to be encouraged; the system of entering into agreements with riparian owners may, therefore, be continued for the management of River Reserves, outside the zone of protection of anti-malarial works, above specified, or where the above restrictions do not apply (see paragraphs (*c*), (*e*), (*f*) and (*g*) above).

(*k*) No cane plantations should, however, be allowed in river reserves on account of possible pollution by manure.

20. With a view to carrying out the above recommendations, the Committee suggests the appointment of a standing Board composed of the Directors of the Health and Forests Departments. The Board should be provided with two special Executive Officers having some knowledge of sanitation and forestry and possessing the standing of Forest Inspectors. The Committee considers that it is not possible for a single officer to exercise an efficient control over all the detail likely to arise in this connection throughout the Island. These officers would have to supervise generally the management of the reserves and to check carefully all growing stock in the vicinity of Estate camps and villages, to attend to the numerous applications which are daily received for the cutting and removal of dead, dying, worm-eaten and otherwise undesirable trees, and to supervise the replanting of blanks.

These Officers could suitably be styled Inspectors of River Reserves, and should receive the pay of Forest Inspectors, *i.e.*, Rs. 1,800 p.a., with Rs. 700 as travelling allowance. The total outlay, Rs. 5,000 p.a., should, in the opinion of the Committee, be charged against anti-malarial works.

E. KŒNIG,
Chairman.

F. J. R. MOMPLÉ,
Acting Medical Director.

H. A. TEMPANY,
Director of Agriculture.

P. KŒNIG,
Director of Forests.

16*th August*, 1919.

Appendix IV.

EXTRACTS FROM ALCOHOL ENQUIRY COMMISSION REPORT, 1919.

Liquor consumed in the Colony is either imported or manufactured locally. Imported liquor includes whisky, brandy, gin, vermouth, rum (in exceedingly small quantities), liqueurs and cordials, wine of every description, ale, beer, porter, cider, etc.

The local product is rum, obtained by the distillation of sugar cane molasses. It is generally consumed as it comes from the distillery, or after having been artificially coloured or flavoured, subsequent to distillation (*Rhum préparé*). Of late, compounders have placed comparatively large quantities of " prepared rum " on the market, in the shape of local " brandy," " liqueurs," etc.

In this, as in almost all countries, the State levies heavy taxes on manufactured alcohol, mainly as a source of revenue. The duties collected on imported liquor during the ten years 1909-1918 amounted to Rs. 3,015,638, the yearly average being Rs. 301,563. The highest figure Rs. 350,304, reached in 1913, was Rs. 48,741 in excess of the average; the lowest, Rs. 199,238, in 1918, was Rs. 102,325 below the average. Owing to the war there has been a notable falling off in importation, causing a corresponding decrease in this source of revenue.

LOCAL MANUFACTURE—EXPORT—LEGISLATION.

Distillation of spirits is, at present, carried on in three distilleries: *Namking*, in the district of Rivière du Rempart; *Phœnix*, in the district of Flacq; and *Bonne Terre*, in the district of Plaines Wilhems. These distilleries are not working at anything like full strength, Namking and Phœnix only working about 15 days, and Bonne Terre only 7 days a month.

An agreement exists between the owners of Namking (The Mauritius Chinese Distillery and Alcohol Co., Ltd.) and of Phœnix (Mr. E. Tostée), whereby the two distilleries supply by halves nearly the whole of the rum consumed in Mauritius, but the proceeds of the sales are divided in the proportion of 60 to 40. The combine turns out about 2,000 litres of " denaturated " alcohol monthly. Bonne Terre sells rum to certain Indian traders, and also for export to Rodrigues and Seychelles. It supplies the bulk of " denaturated " alcohol which is consumed in Mauritius.

The three distilleries in question were visited by the Commission. The reports of the Director of Agriculture on those visits, a paper of Mr. de Sornay, and evidence submitted, all point to the possibility of improving considerably, both in quantity and quality, the manufacture of spirits in Mauritius. The plant used is defective, so is the fermentation. Proper chemical control during distillation is eminently desirable.

The volume of rum exported, duty free, during the 10 years 1909-1918 was 1,881,592 litres, or a yearly average of 188,159 litres. There is evidence, however, that, but for the want of suitable packages, the local production would not have been sufficient to meet the export demand. Casks are extremely dear, and tins are not looked upon with favour on account of the acidity in our alcohol.

The manufacture of spirits, and the working of distilleries, are governed by laws which impose extremely severe and rigid conditions on manufacturers, in order to safeguard the revenue. It has been urged upon the Commission that some of the provisions of the existing laws might be made more elastic in order to promote the development of the industry.

RETAIL OF LIQUOR—CONTROL.

Liquor is obtained either from importers or from local distillers. It is accessible to the general public mostly through persons licensed as:—

(1) Consolidated retailers;

(2) Retailers of spirits, wine and beer; and

(3) Keepers of houses of entertainment who are sub-divided into:

- (*a*) Keepers of hotels and inns;
- (*b*) Keepers of taverns or restaurants;
- (*c*) Keepers of refreshment rooms; and
- (*d*) Keepers of public billiard rooms.†

Consolidated retailers, retailers of spirits, wine and beer, and hotel or inn keepers are authorised to sell spirits. Wine and beer* to be consumed *on* or *off* the premises where they are sold.

Keepers of taverns, restaurants, refreshment rooms, public billiard rooms may sell spirits, wine and beer to be consumed *on* their premises only.

Hotels or inns may remain open night and day.

Consolidated retailers and retailers of spirits, wine and beer cannot open their establishments before 5 o'clock in the morning and must close them at 9 o'clock at night.

The opening and closing hours for taverns, restaurants and public billiard rooms are 5 a.m. and 11 p.m.

There are no "inns" properly so called in the Island, and not half a dozen of *real* hotels. The other "hotels" are places for which the licence duty appears to be paid merely to enable drink being sold uninterruptedly day and night.

The average number of "hotels" for the years 1917-18 and 1918-19 was 80. There were 39 retailers of spirits, wine and beer, keepers of taverns and refreshment rooms in 1917-18 and 48 in 1918-19, or an average of 44 a year. Consolidated retailers numbered 1,789 in 1917-18 and 1,715 in 1918-19, or an average of 1,752 per annum.

Consolidated retailers and hotel keepers are therefore the largest suppliers of liquor, but the former by far out-number the latter, the proportion being 20 to 1.

There is a class of consolidated retailers of a superior grade, the owners of large grocery establishments, who do not avail themselves of the privilege conferred upon them by law, and who confine themselves to selling liquor to be consumed *off* their premises; but the majority of consolidated retailers and hotel keepers is composed of Chinese traders who supply their customers, belonging mostly to the working classes, with liquor, principally rum, in pints (*chopines*), and in small measures, popularly known as *topettes* or *petits baquets*, which is consumed *on* the premises. The typical Chinese shops, which are scattered all over the Island, are so well known as to require no description.

Any number of licences may be issued to persons who wish to carry on the trade of consolidated retailers, or of retailers of spirit, wine and beer. No statutory distance is prescribed between any two places where liquor can be sold, a striking example being Farquhar Street, Port Louis, where from Place d'Armes to Immigration Square, a distance of 220 paces, there are no less than 13 drink shops. Very much the same deplorable state of things prevails in the townships, and other populous places.

With regard to "houses of entertainment," the Governor may limit the number of licences in any district, but this power would appear to be seldom, if ever, exercised.

There is, in every district, a Licensing Committee appointed for the purpose of examining applications to keep "houses of entertainment," with power to admit or reject such applications. A Licensing Committee's authority is only required for a first licence, after which successive licences may be issued by the Receiver-General, without reference to the Committee, if no complaint has been lodged against the renewal of the licence. According to the Superintendent of Inland Revenue the duties of a Licensing Committee are confined to an enquiry into the character of the applicants for licences, and the situation of the premises where the business is to be carried on, and which must not be too near places of public worship.

The control of the police over drink shops is confined to the maintenance of order. This information was given by the then Acting Inspector General of Police, who said that, in the majority of cases of men found drunk in the streets, the police merely saw them home, prevented them from getting into further trouble, and did not necessarily arrest them. This was only done when the person was helpless or violent and had to be taken to the Police Station. It is only such cases that are actually recorded, and the police records therefore merely indicate the number of arrests for drunkenness.

The Licences (Consolidating) Ordinance, 1915, contains many provisions regarding the sale of adulterated liquor and of diluted rum; the receiving of spirits, wine and beer from unlicensed persons, the possession of spirits, wine and beer contained in vessels having fraudulent labels, marks or brands; the sale of spirits to drunken persons or to children; the permitting of drunkenness or disorderly conduct, or of gambling on licensed premises, etc. It appears that the Inland Revenue Officers and Guards devote the whole of their attention to verifying whether the spirits sold have been adulterated, or diluted, and to illicit distillation, which is still carried on though not on the same scale as in the past. (Evidence of the Superintendent of Inland Revenue.)

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† Public Billiard Rooms are authorised by law, but there are none at present.

* Spirits, Wine, Beer, are defined as follows by Article 3 of Ordinance No. 32 of 1915: "Spirits" shall mean any alcoholic liquor, plain or compounded, and shall include Rum, Arrack, Brandy, Gin, Whisky, Cordial and Liqueurs. "Wines" shall include Wines of all descriptions however made and whithersoever imported. "Beer" shall include Ale, Porter, Cider and all other fermented liquor except toddy (calou)."

CONSUMPTION OF RUM.—ITS ALARMING GROWTH.

The volume of rum issued for consumption from the 1st July, 1909, to the 30th June, 1919, was 10,227,852 litres, or an average of 1,022,785 yearly. The maximum was 1,384,240 litres in 1917-18 and the minimum 704,087 litres in 1909-10. In 1919-20, the enormous total of 1,832,589 litres was reached, being 809,748 litres in excess of the average, and 1,128,466 litres above the lowest consumption. In other words, in the last financial year, the quantity of rum drunk in the Colony was more than double it was ten years ago, and that quantity exceeded by nearly 80 per cent. the average of the preceding ten years.

Considering that there has been no abnormal change in the population of the Colony, this growth in the sale of drink is threatening. It may be attributed, to a slight extent, to the fact that some people who formerly used imported liquors only, have now taken to rum, owing to reduced imports, higher prices, etc. It may also be that female intemperance, and a tendency to over-indulgence among the younger generation of the upper classes—two unfortunate features which were brought to the notice of the Commission—are factors in the problem; but these cannot be and are not in fact the only reasons. It is painfully and strikingly evident that the working classes have of late shown a marked and increasing propensity to the immoderate use of intoxicants, in the form of their favourite drink, which is rum. There is, on that point, overwhelming evidence given by Ministers of Religion, Owners and Managers of Sugar Estates, Planters, Distillers, Dock Managers, Stevedores, Sellers of Spirits, Managers of Engineering Works, and others. It is absolutely certain that fishermen, artisans, agricultural and dock labourers and the lower classes generally, are becoming more and more intemperate, and that the progression is so alarmingly rapid, that a considerable number of them are or will soon be, victims of alcoholism, the augmentation being especially noticeable among the Indian and Indo-Maurician population.

The dangers of alcoholism are so well known that they do not require to be expatiated upon, but some of them may be usefully referred to here: Loss of the will power, decrease of capacity for work, less resistance to disease, pauperism, degradation, ending in crime and untimely death. It also affects the quantity and quality of the work required by employers of labour, a question of vital importance at the present moment.

Many causes contribute to the present state of things, notably:—

(1) The multiplicity of opportunities and temptations afforded to lovers of drink of gratifying their passion, by the numerous shops where liquor is sold.(1)

(2) The defective control of these places.

(3) The alcoholic strength of the beverage sold: an important consideration when one bears in mind that most of the customers of the Chinese shops drink raw rum, *i.e.*, rum reduced from 23° to 20° Cartier.

(4) The excessive number of hours during which drink is obtainable.

(5) Want of proper housing.

(6) Ignorance of the danger of alcoholism.

TOTAL PROHIBITION NOT TO BE ADOPTED AT PRESENT.

To avert the dangers of alcoholism, the choice lies between Control and Total Prohibition. Most of us are, in principle, in favour of Total Prohibition, but, after mature consideration, we are of opinion that the recommendation of such a radical measure is impossible, for the present, and that the only alternative is the adoption of a system of rigorous control.

---

(1)The number of drink shops in 1918–1919 was 1,864. According to a calculation made by the Hon. G. Gébert, one of the members of the Commission, this represents one shop for 197·80 inhabitants, the consumption being 376 litres per inhabitant, or 838 litres per head of population, excluding women and children under 15.

RECOMMENDATIONS.*

We, therefore, beg to recommend as follows:—

I. That Licences to sell Spirits, Wine and Beer, by retail, to the public, be only issued to (*a*) Consolidated Retailers; (*b*) Restaurant Keepers, and (*c*) Hotel Keepers.

(*a*) A Consolidated Retailer will be a person trading as the owners of the large grocery establishments mentioned in page 42, § 111, of this Report. He will sell not only foodstuffs and other necessaries and commodities, but also, to be consumed *off* his premises, Wine and Beer in closed vessels of the capacity of not less than a pint (locally known as *chopines*), and Spirits in closed vessels of the capacity of not less than a bottle (*i.e.*, a double pint or *bouteille*). Consolidated Retailers will only be allowed to trade in the Town of Port Louis, and in Townships and Proclaimed Villages. Their number is not to exceed one for every 1,000 inhabitants(1) in such Town, Township or Proclaimed Village. Their premises must be closed from six o'clock in the evening until seven o'clock in the following morning.

(*b*) A Restaurant will be an eating-house where meat, fish, and other eatables are prepared and cooked for sale to all applicants. It may also deal in preserved provisions. The Licence duty will cover the sale, by retail, to be consumed *on* or the premises, of spirits, wine and beer, subject, in the case of *off* consumption, to the restriction imposed on the sale by a consolidated retailer. Restaurants must not be kept outside the town of Port Louis or of townships and proclaimed villages. The number must not exceed 1 for every 3,000 inhabitants(1) in such town, township or proclaimed village. On Sundays no drink must be supplied in a restaurant except with meals. A restaurant cannot open before 7 a.m. and must close at 9 p.m., but an occasional licence may be issued, for extension of the hours of sale, whenever the Receiver-General shall consider it necessary for the accommodation of the public.

(*c*) An hotel will be a place which is structurally adapted, fitted and furnished for the reception, whether in suites of apartments, or in single rooms, of lodgers who are provided with food, if they so desire, and with liquor to be consumed *on* or *off* the premises; subject, in the case of *off* consumption, to the restrictions imposed on the sale by a consolidated retailer. The supply of liquor to the guest of a lodger will be considered as a supply to the lodger himself, if the latter pays for the liquor. The licence will cover a sale to a *bonâ fide* traveller, *i.e.*, a person who lodged during the preceding night at a place at least three miles distant from the hotel where he asks to be supplied with liquor, that distance being calculated by the nearest public thoroughfare. Hotels may remain open night and day. They must be kept only in the town of Port Louis, or in townships and proclaimed villages. Their number must not be in excess of 1 for every 3,000 inhabitants.

An "On" or "Off" licence is not to be issued to the holder of an "Off" licence, in respect of the premises to which the latter licence applies.

II. That the importation, manufacture and sale of "Absinthe" be prohibited.

III. That the manufacture of some light drink as "Kaffir" beer be encouraged.

IV. That the excise duty on rum be raised to at least Rs. 3.50 per litre at 23° Cartier.

V. That the import duties on foreign spirits be increased in the same ratio, and that the duties on ordinary wines containing more than 12° of alcohol be also raised.

VI. That, with a view to popularising the consumption of hygienic drinks, the import duties on beer and porter, not containing more than 4 per cent. of alcohol, and on cider, should be reduced.

VII. That the licence duty for selling liquor be raised.

VIII. That no action lie for the sale on credit of liquor in "On Licence" premises.

IX. That the giving of liquor in payment of salaries and wages, or as a gratuity, be prohibited.

X. That provision be made in the law for the suspension or forfeiture of a licence, in case the licensee has been previously convicted of breaches of the law relating to the sale of liquor.

---

(1) The population must be ascertained according to the last published census for the time being. (Licensing (Consolidation) Act, 1910.)

XI. That the provisions of the law, regarding the sale of liquor, be strictly enforced by the Police and Inland Revenue Departments, by special agents appointed therefor, if necessary, particularly with respect to the sale of spirituous liquor to children.

XII. That the powers of the Licensing Committees be increased, and that the renewal by the Receiver-General of a licence to sell liquor be subject to the recommendation of the Licensing Committee.

XIII. That inasmuch as the proposed restrictive measures may cause a loss to the Treasury, other sources of revenue be tapped to make up for the deficiency.

XIV. That every encouragement be given to persons who endeavour to improve the local manufacture of alcohol by the introduction of better apparatuses, and by the adoption of chemical control of distillery work.

XV. That steps be taken to facilitate technical investigations into the different kinds of denaturants suitable for alcohol to be used in particular industries, and for the use of special denaturants for alcohol for industrial purposes, in the same way as obtains in other States.

XVI. That facilities be accorded for the issue, duty free, to properly authorised persons, of limited quantities of pure alcohol for scientific purposes.

XVII. That the distillery laws be remodelled so as to lead to the development of the spirits industry on modern lines, while safeguarding the revenue derived from that industry.

XVIII. That the action of societies formed for the purpose of suppressing or reducing the consumption of alcoholic drink be encouraged.

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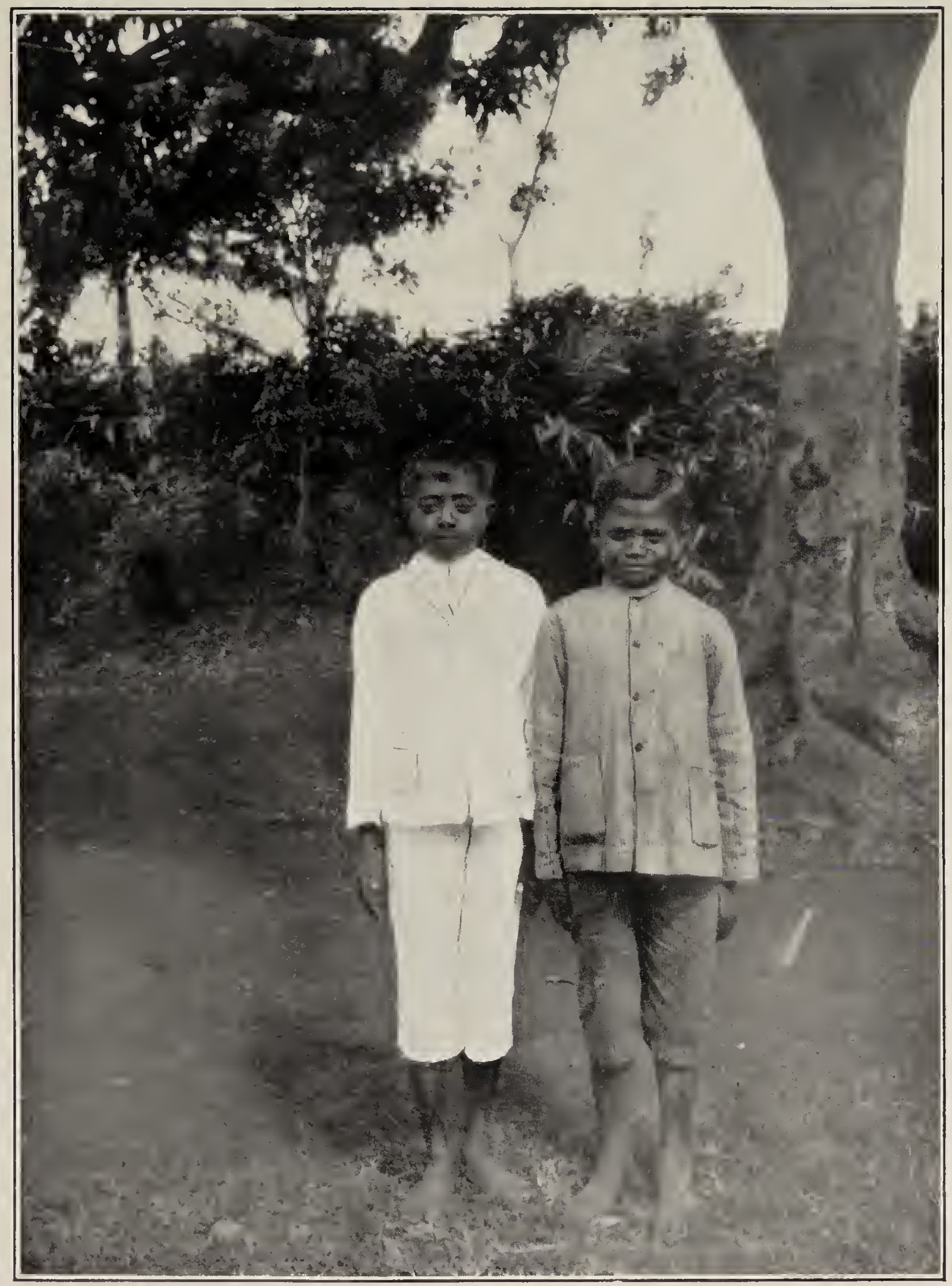
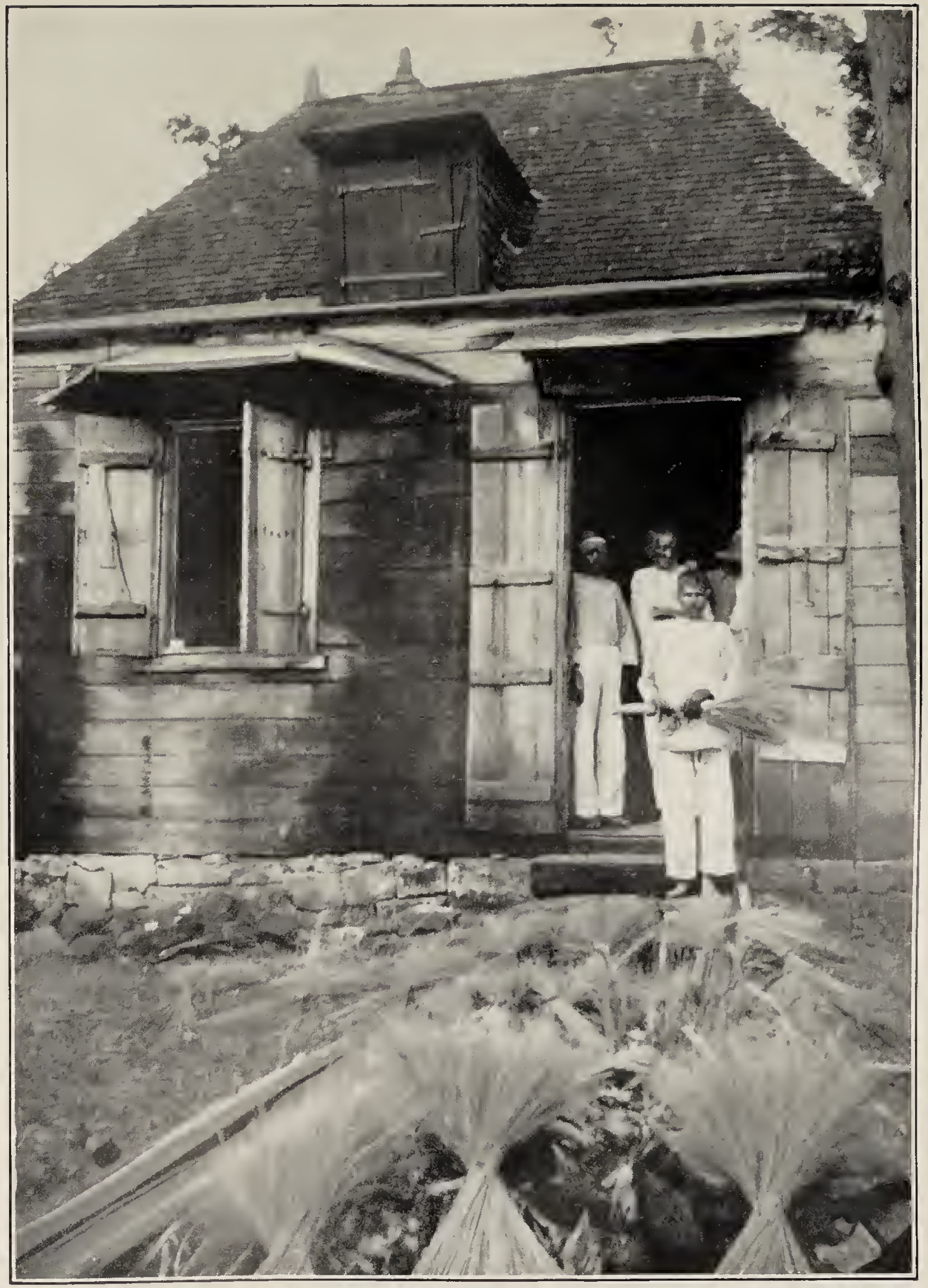


1.—This illustrates the stunting effect of ankylostomiasis on growth. The boy in white is a victim of hookworm disease and is 16 years of age. The other boy is 12 and was found uninfected.



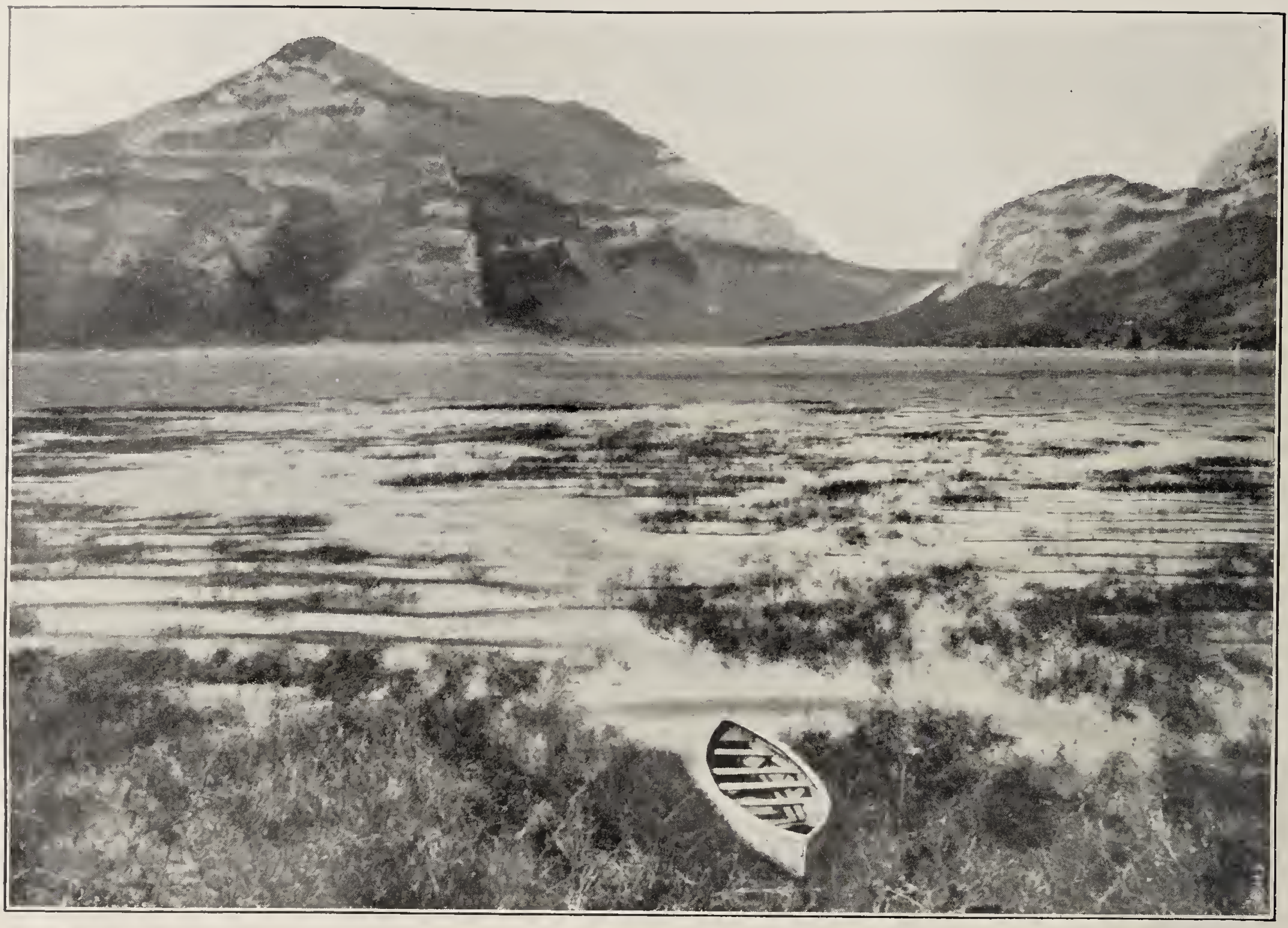
2.—One of the male wards of the Leper Asylum at St. Lazare, Port Louis. Note the grass brooms which are manufactured by the lepers and sold by them to the general public.

3.—Part of administrative block of new leper asylum at Powder Mills, Pamplemousses District.

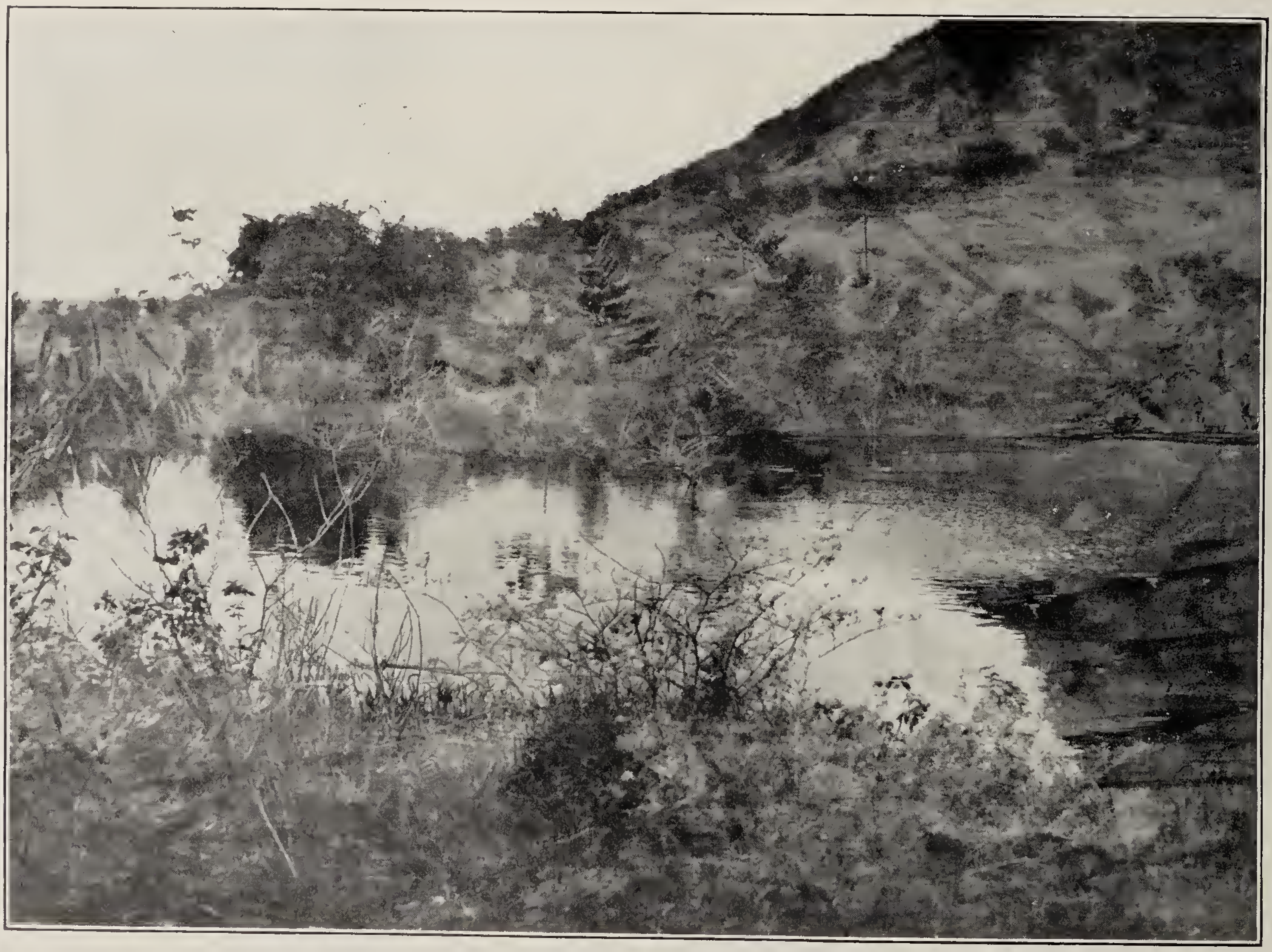
4.—A corner of the Flic-en-Flacq swamp.

5.—A typical marine swamp in the north of the Island.

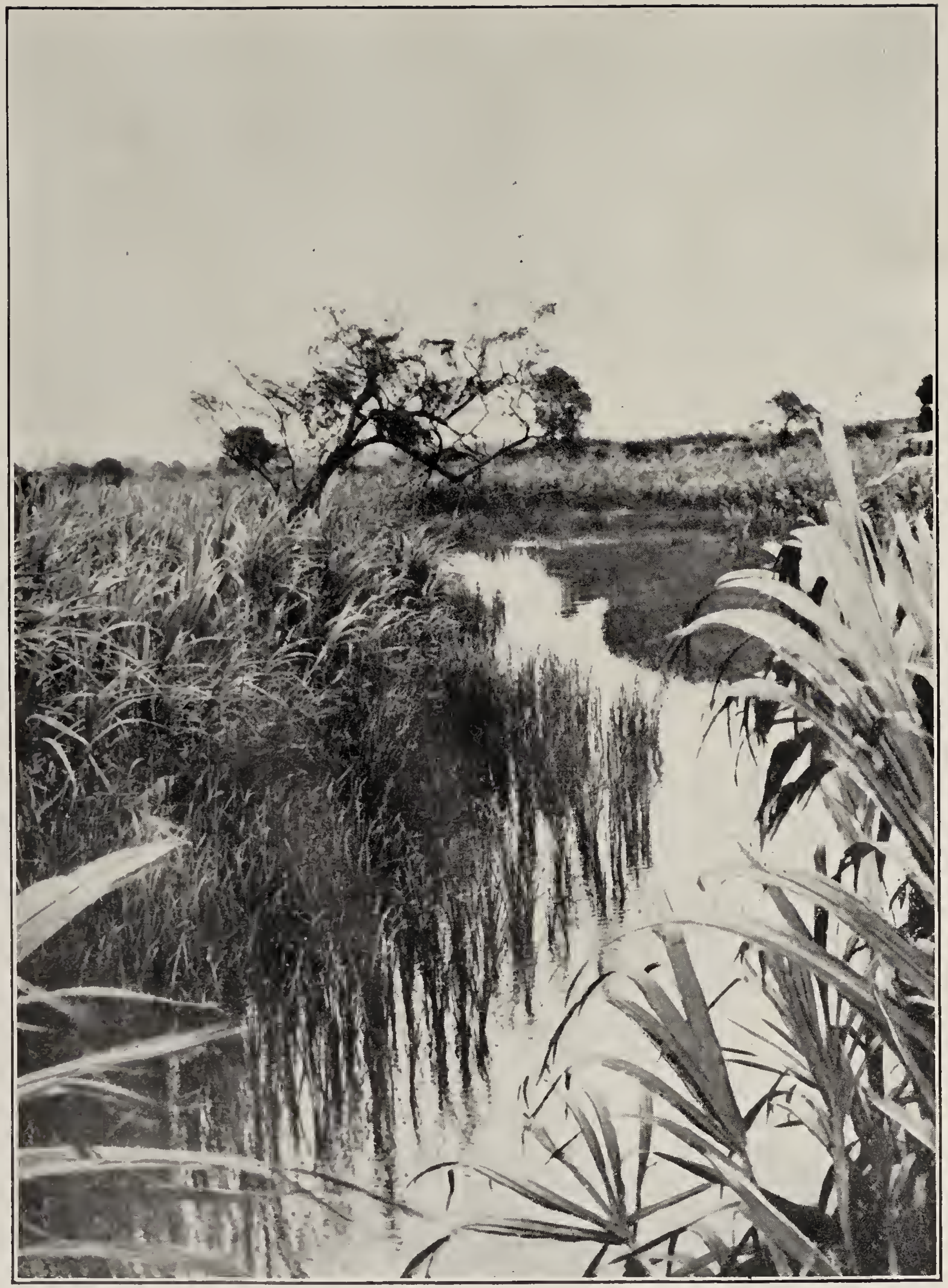
6.—An inland swamp at La Lucie, Flacq.



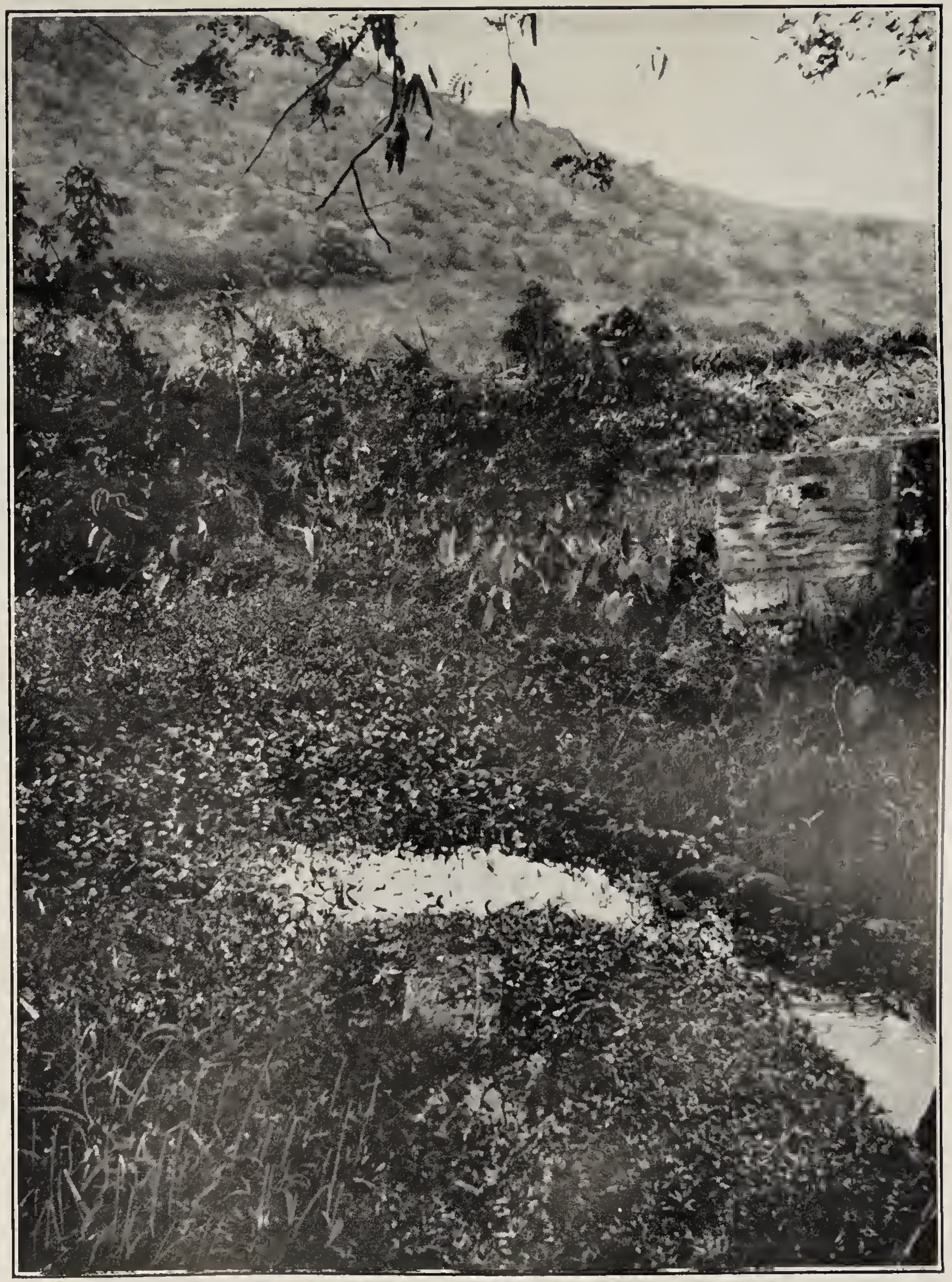
7.—La Ferme Reservoir. The water is at a comparatively low level and convenient breeding places for *A. costalis* are provided.



8.—Large pool formed by water run off from water main at Signal Mountain during repairs to the pipe line. Breeding place of *A. costalis*.

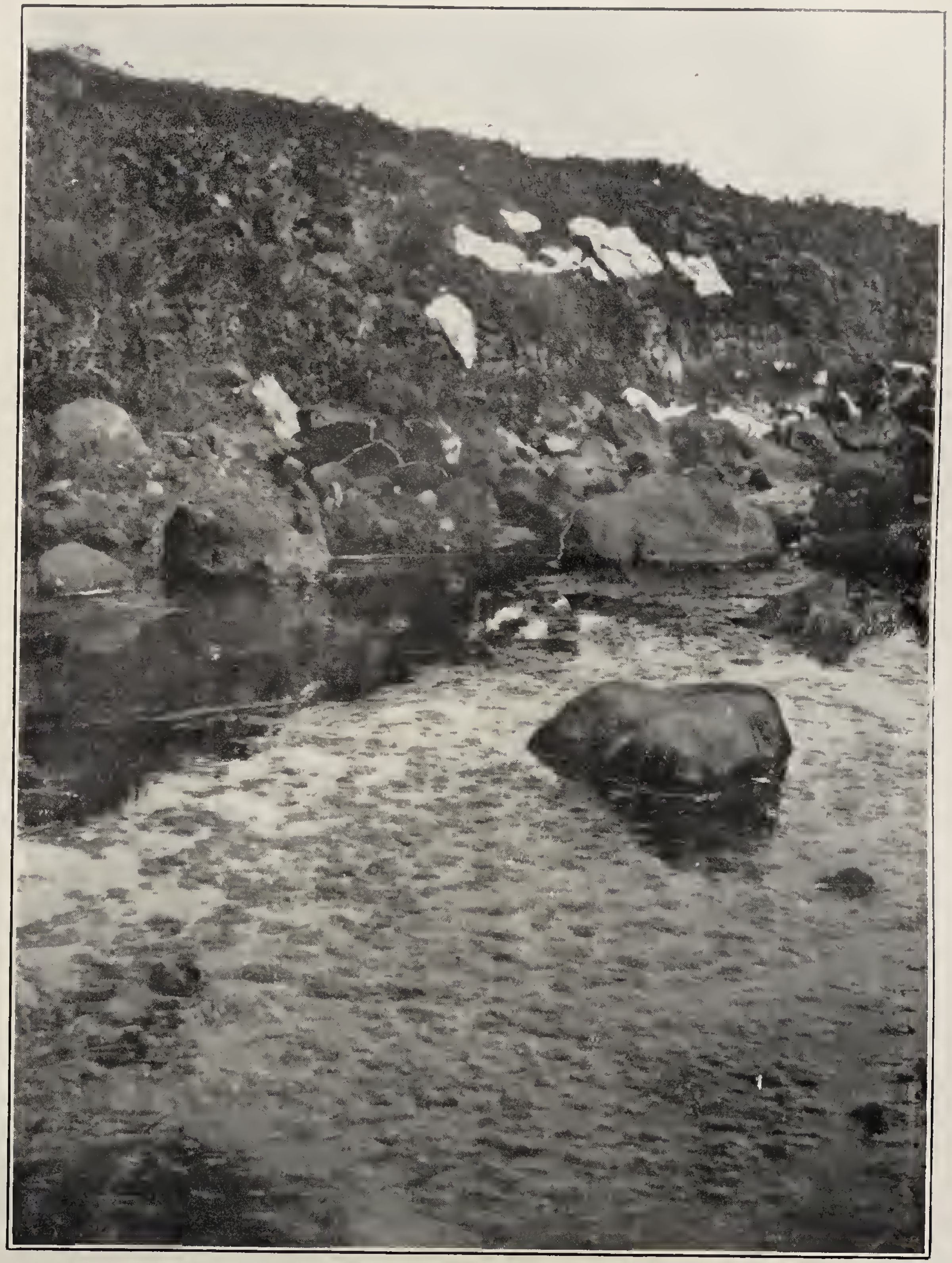


9.—Uncanalized River Françoise near Poste de Flacq.

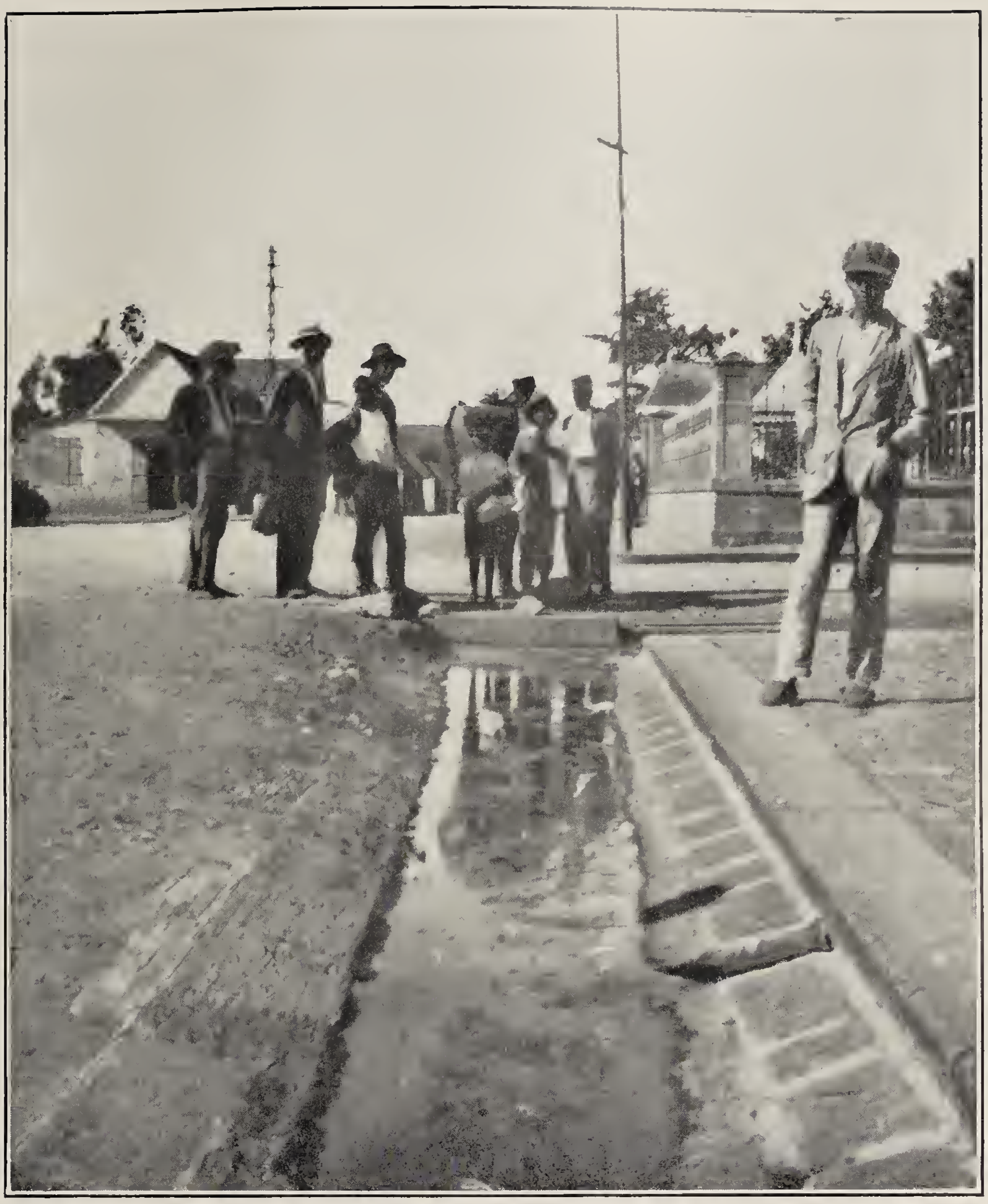


10.—An overgrown water course in Black River District.

11.—An overgrown and neglected water course on a sugar estate, Pamplemousses.

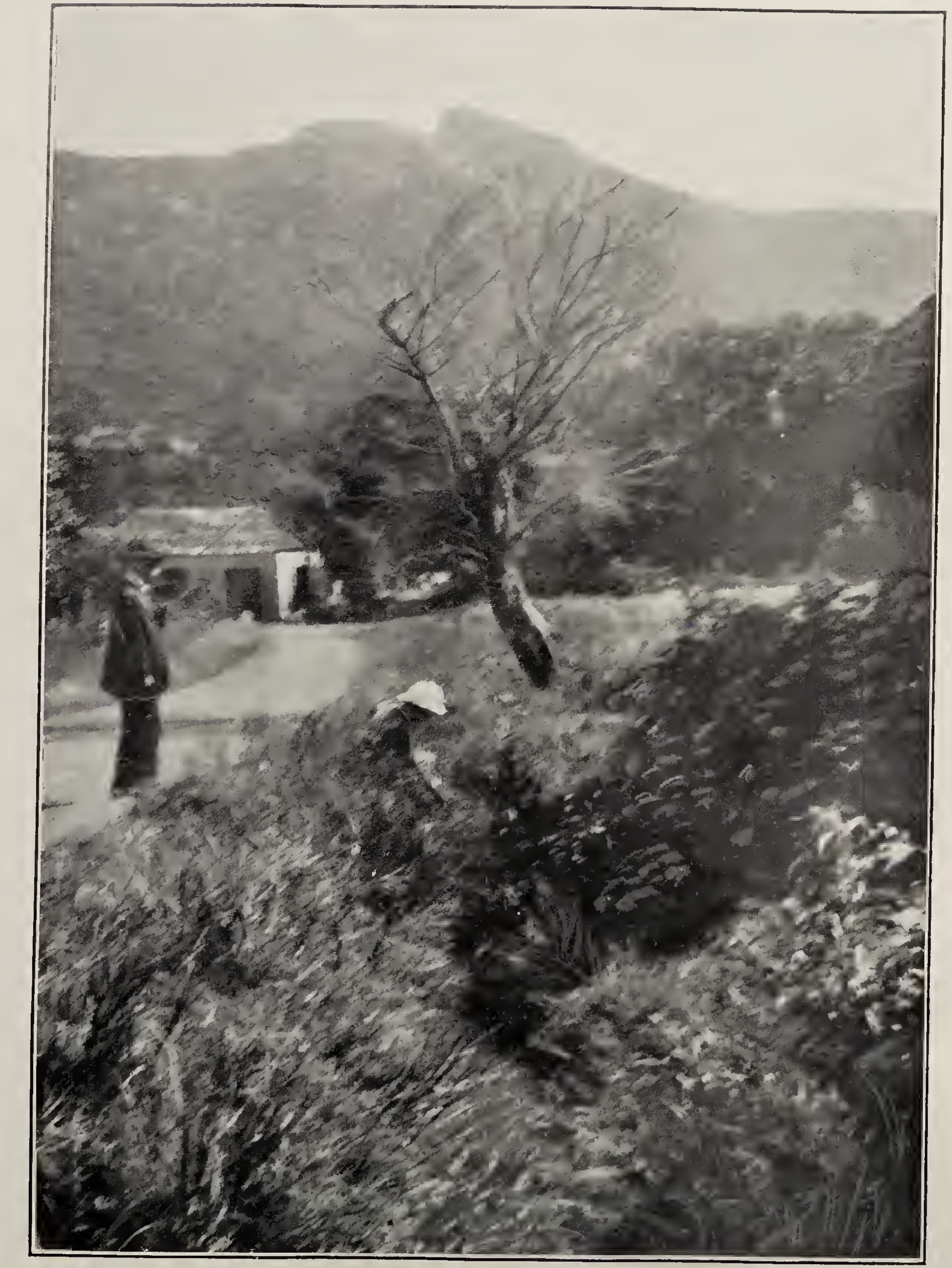


12.—Growth of water weed in a depleted river forming a favourable nursery for *A. costalis*.

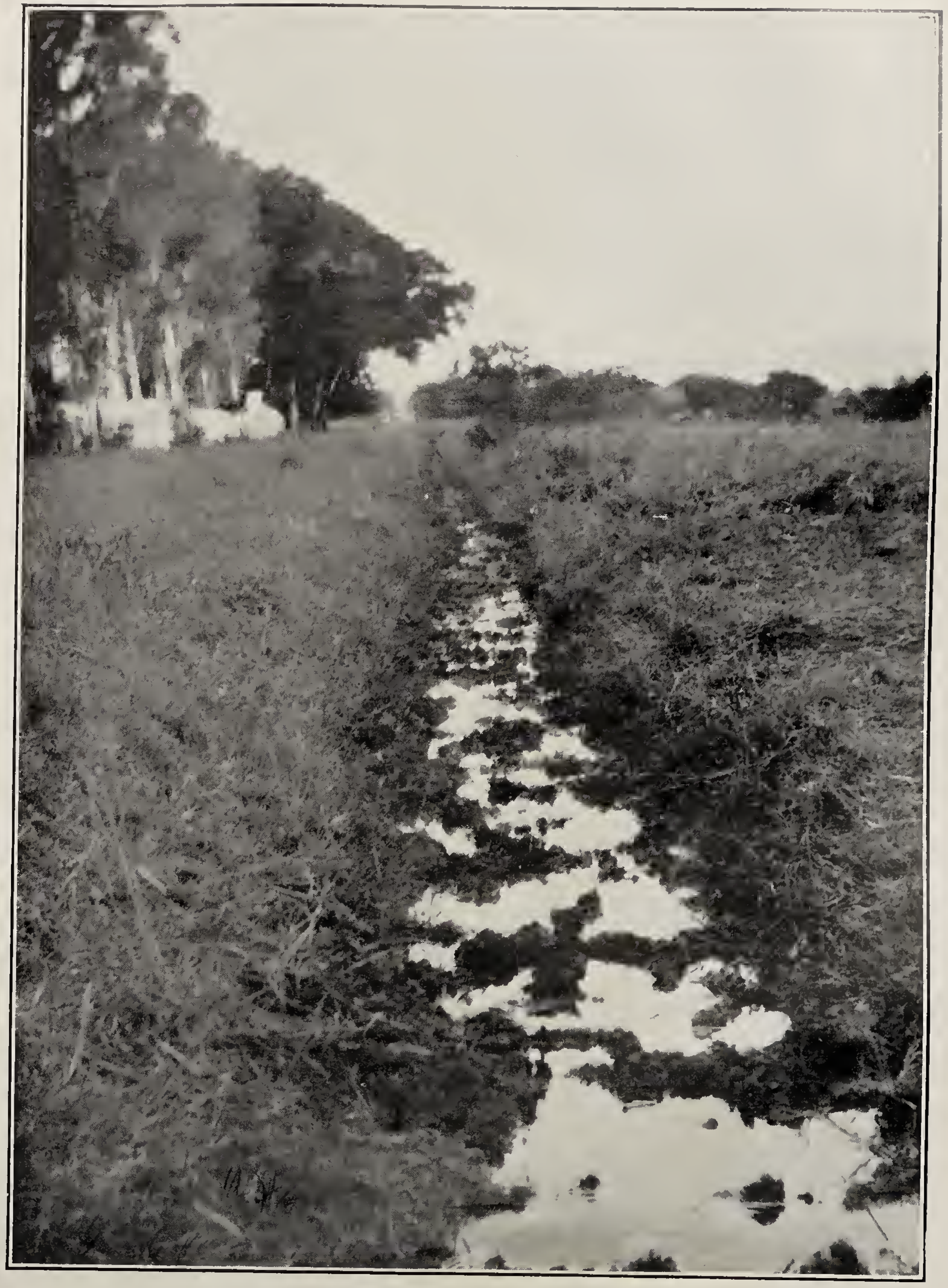


13.—A blocked street gutter, Port Louis; a suitable breeding place for *A. costalis*.

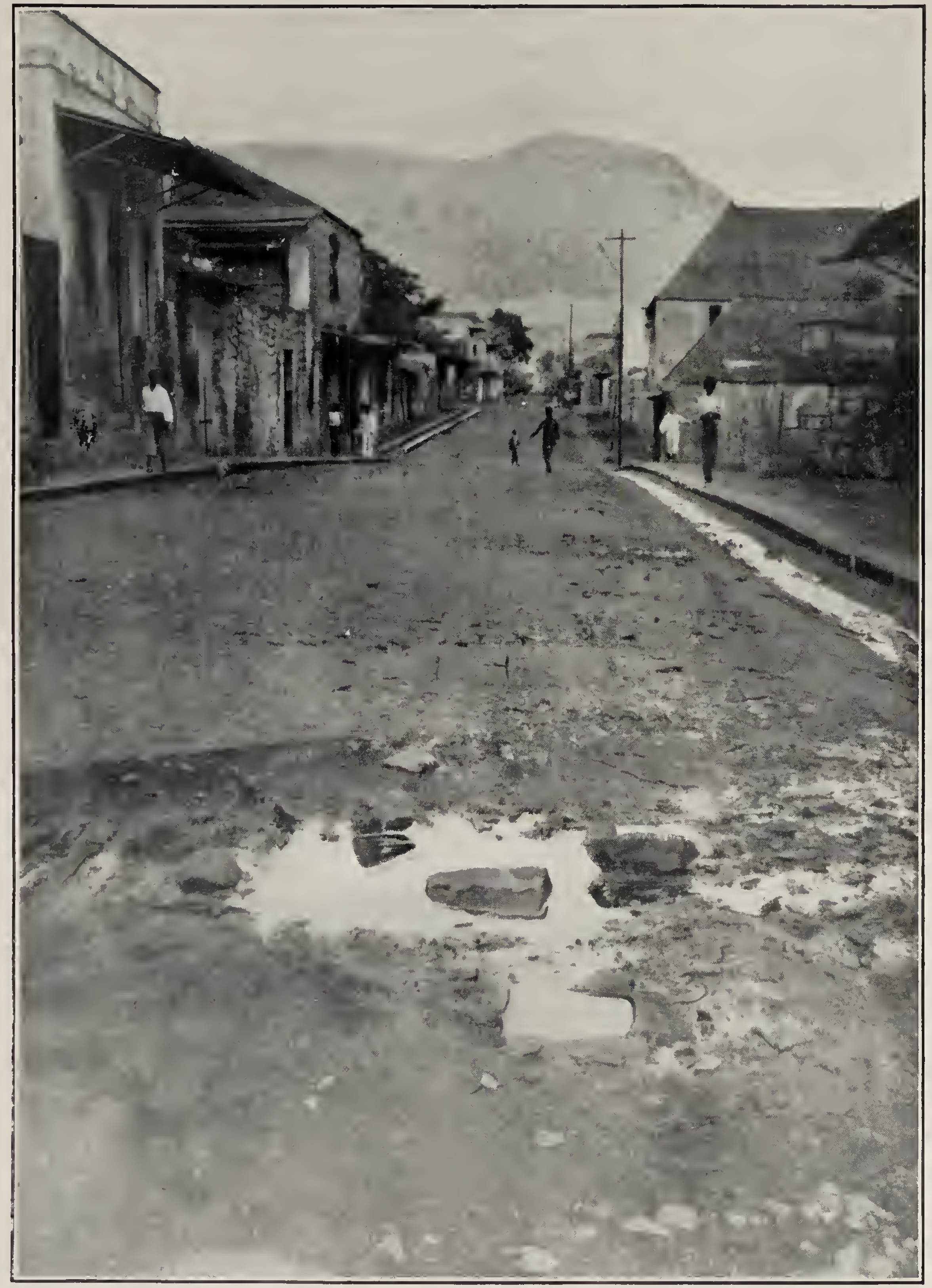
14.—Subsoil water spreading over Pavé. In this shallow layer of water the larvæ of *A. costalis* were found.



15.—An overgrown street gutter. Outskirts of Port Louis. *A. costalis* found in pools amongst the grass.

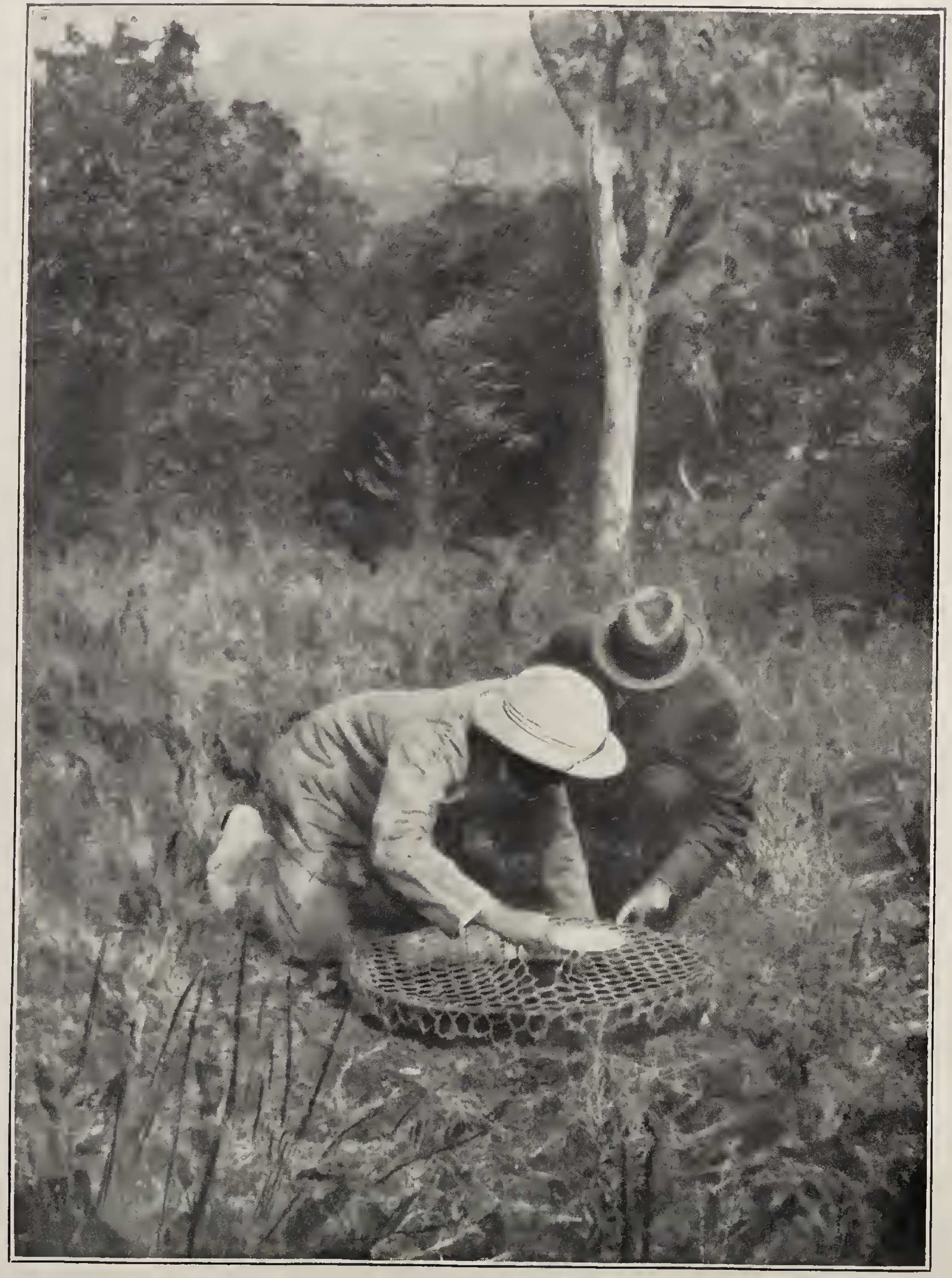


16.—A neglected ditch, near the Eastern Cemetery, Port Louis. It contained the larvæ of *A. costalis.*

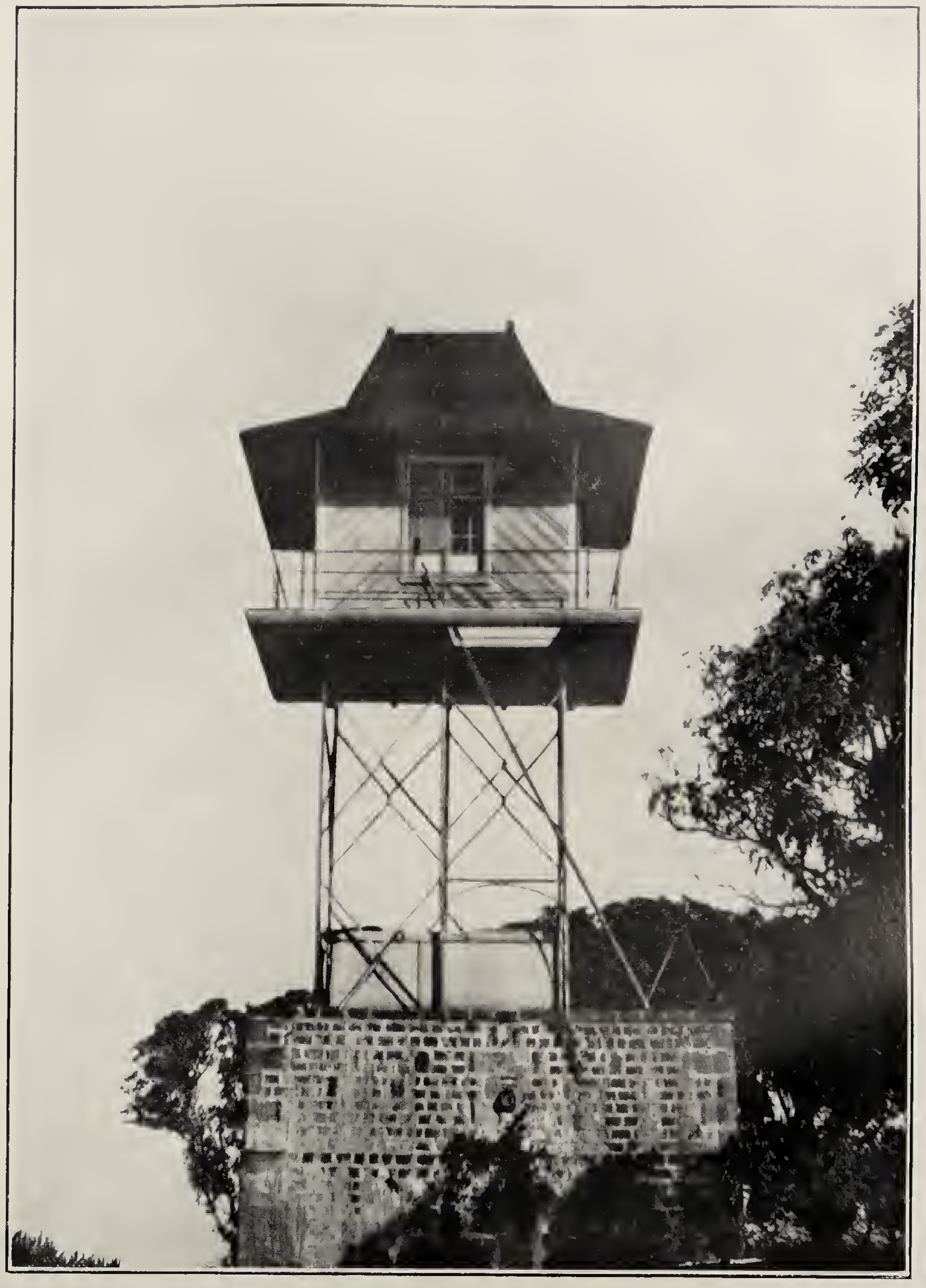


17.—A leaking "Regard" in one of the Port Louis streets — breeding place for *Anopheles costalis.*

18.—Vegetable garden on the outskirts of Port Louis showing irrigation ponds in which mosquitoes may breed.

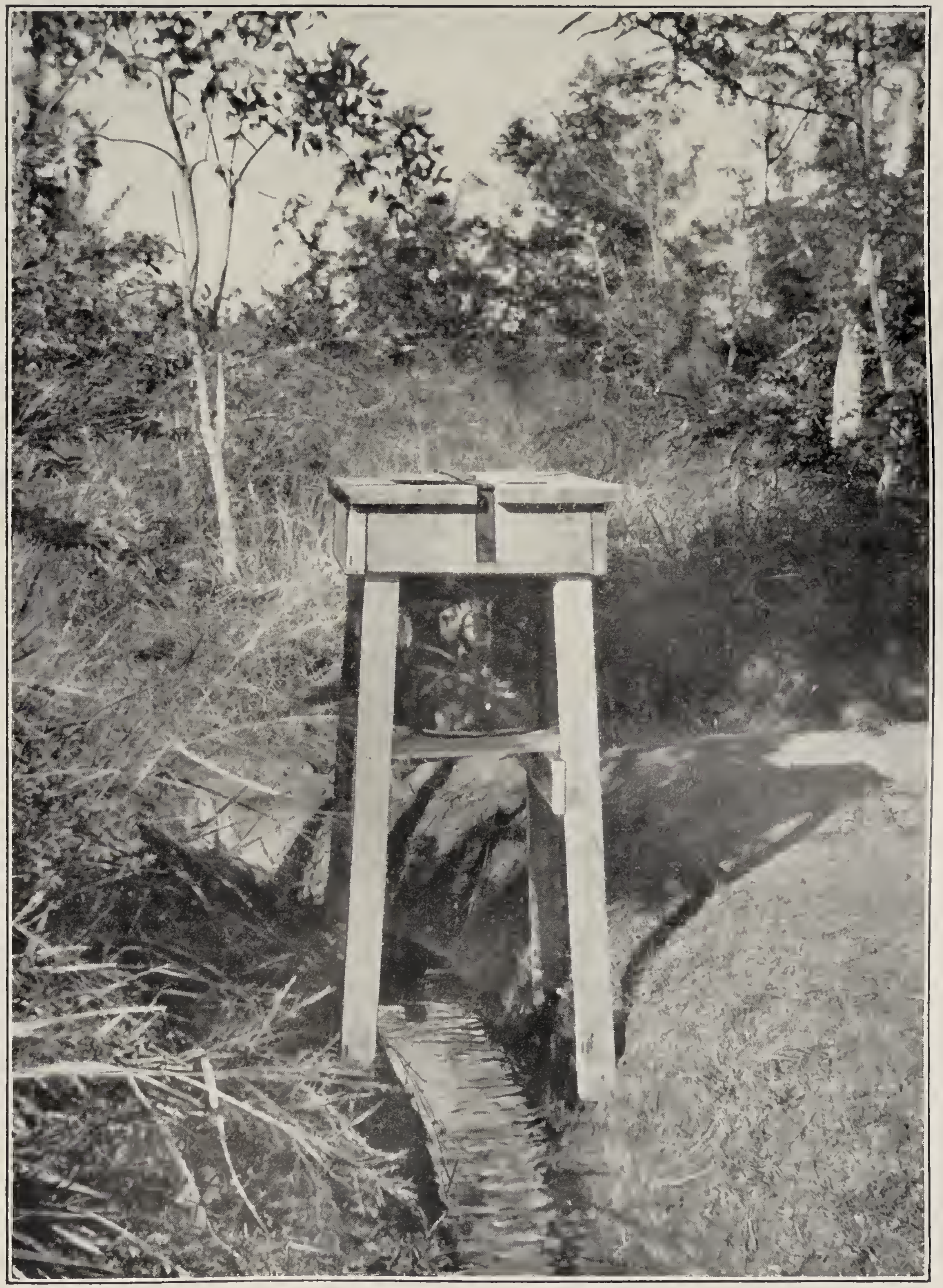


19.—Mosquito trap pool protected by rabbit wire netting from the assaults of pigs and other animals.

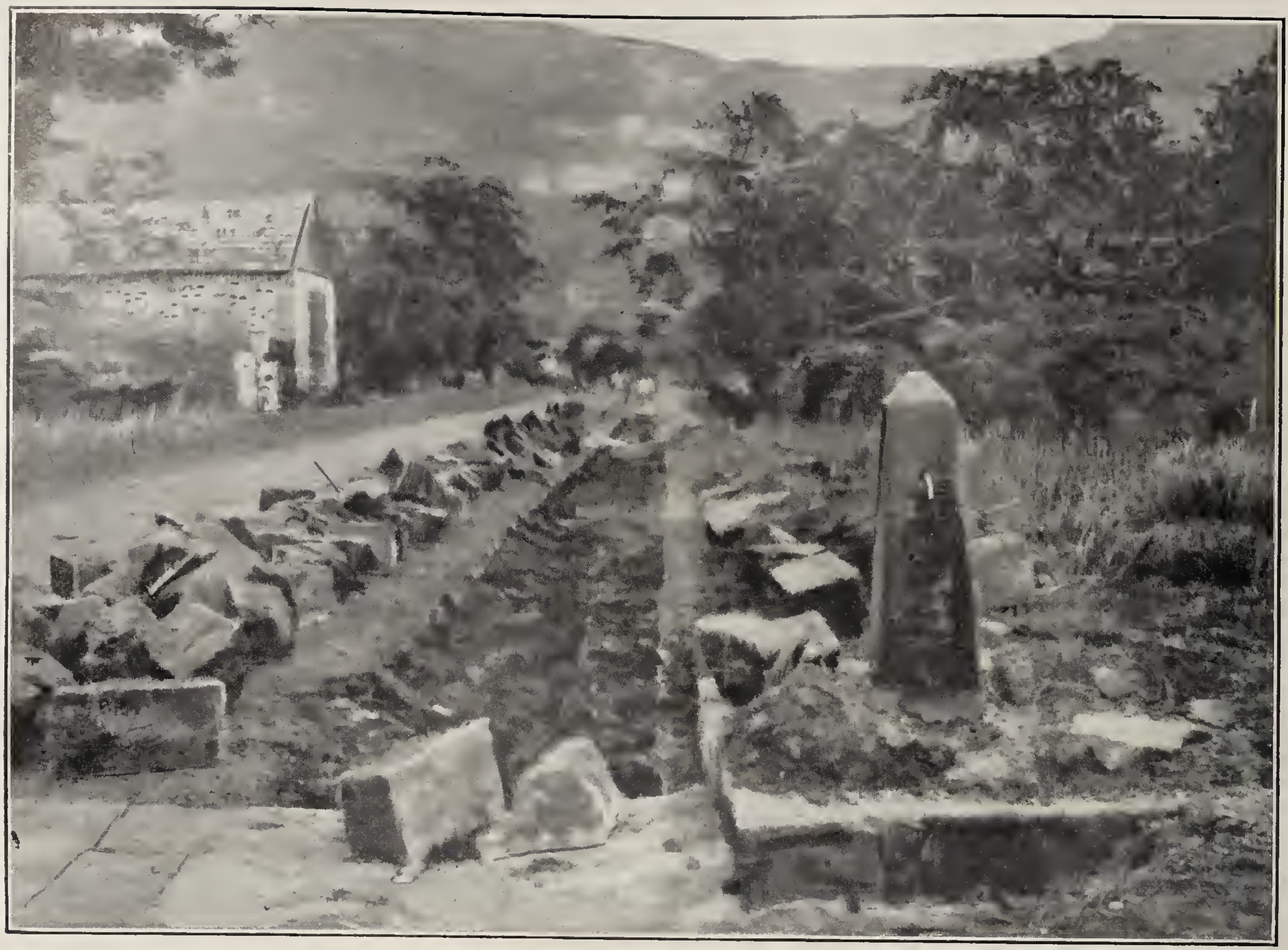


20.—A "mosquito tower" in Pamplemousses District. Erected as a means of avoiding mosquito attack.

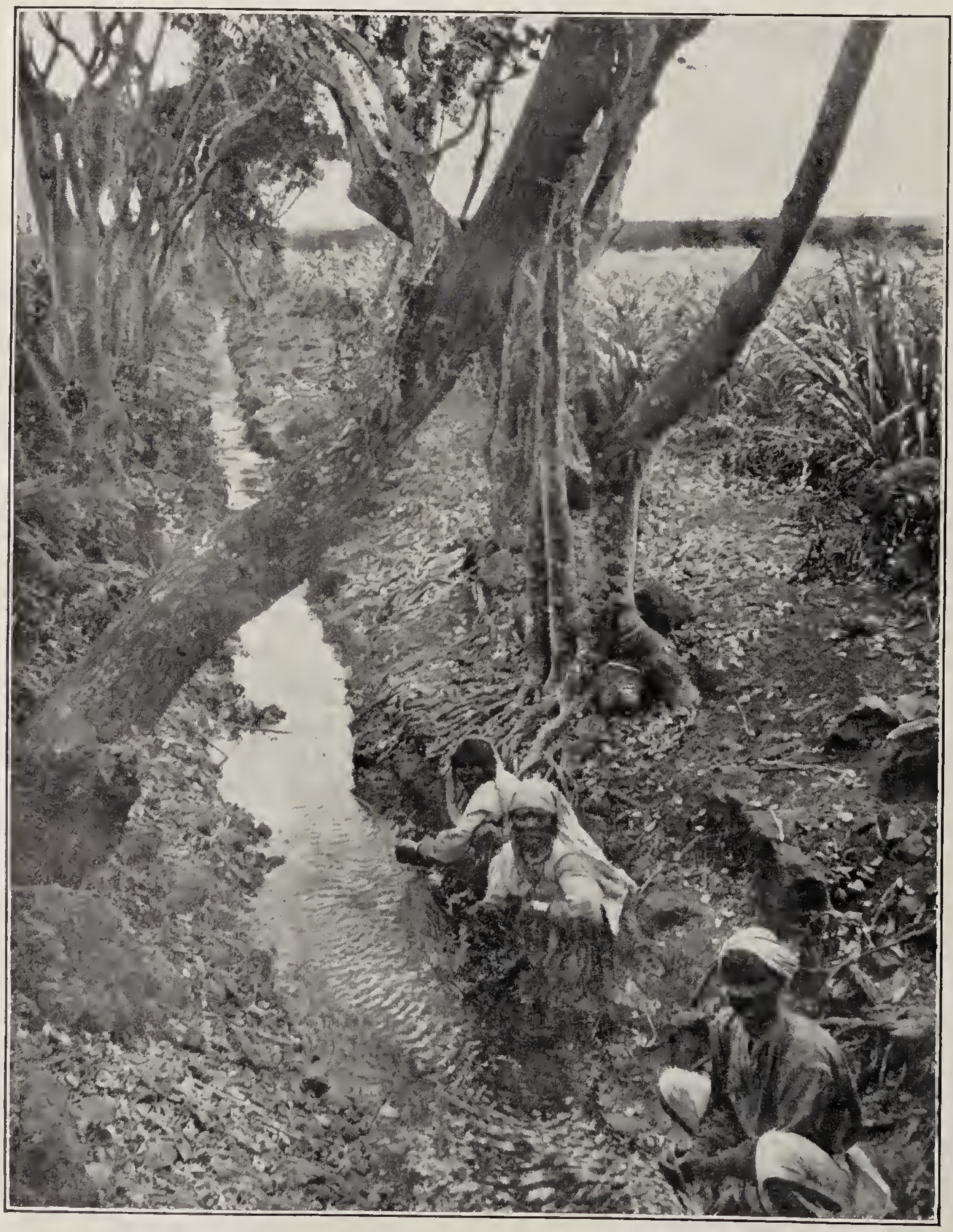
21.—Cleaning weeds from a sugar estate pond used for irrigation purposes.



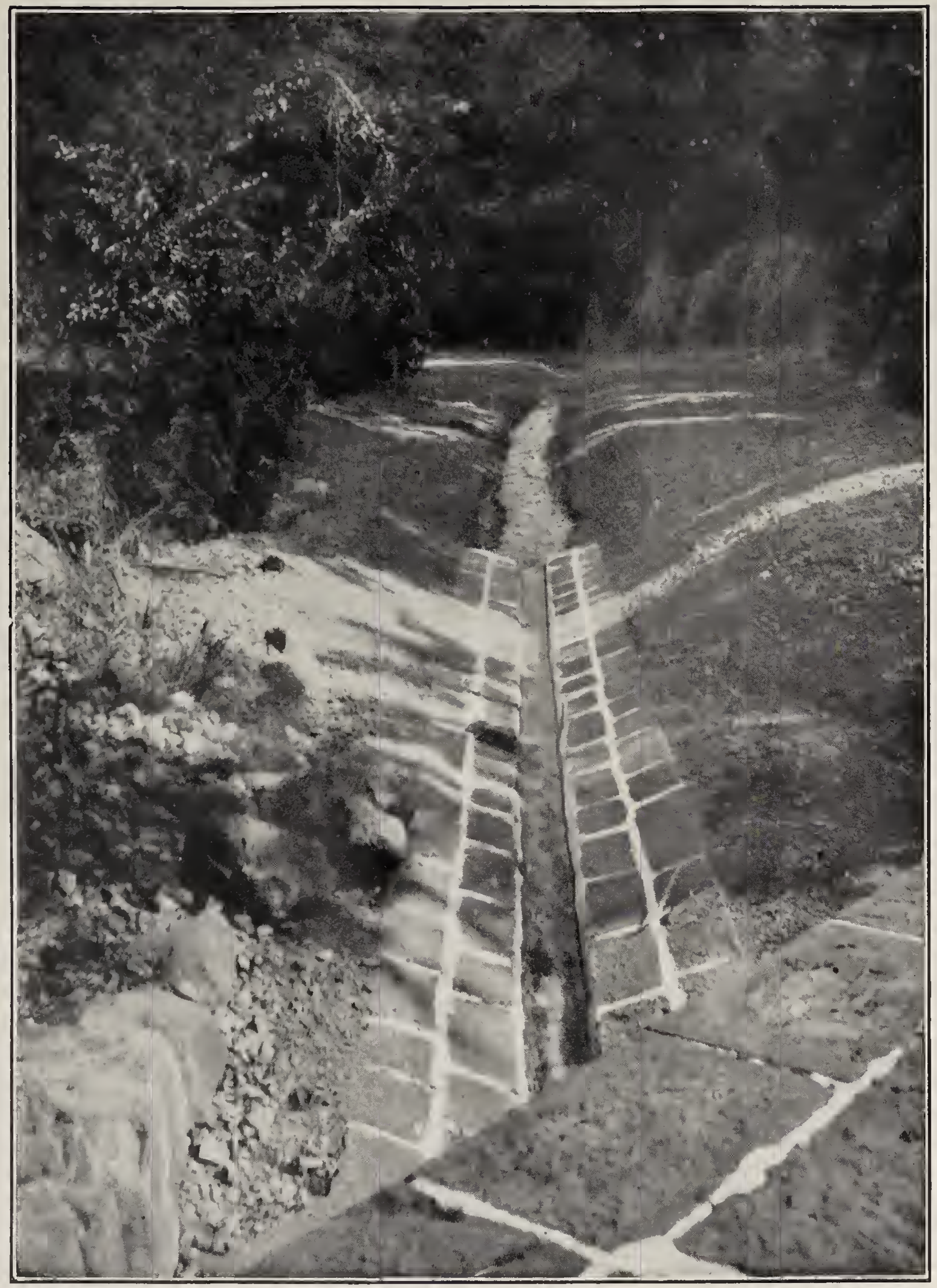
22.—Cresol-drip placed over an irrigation channel.



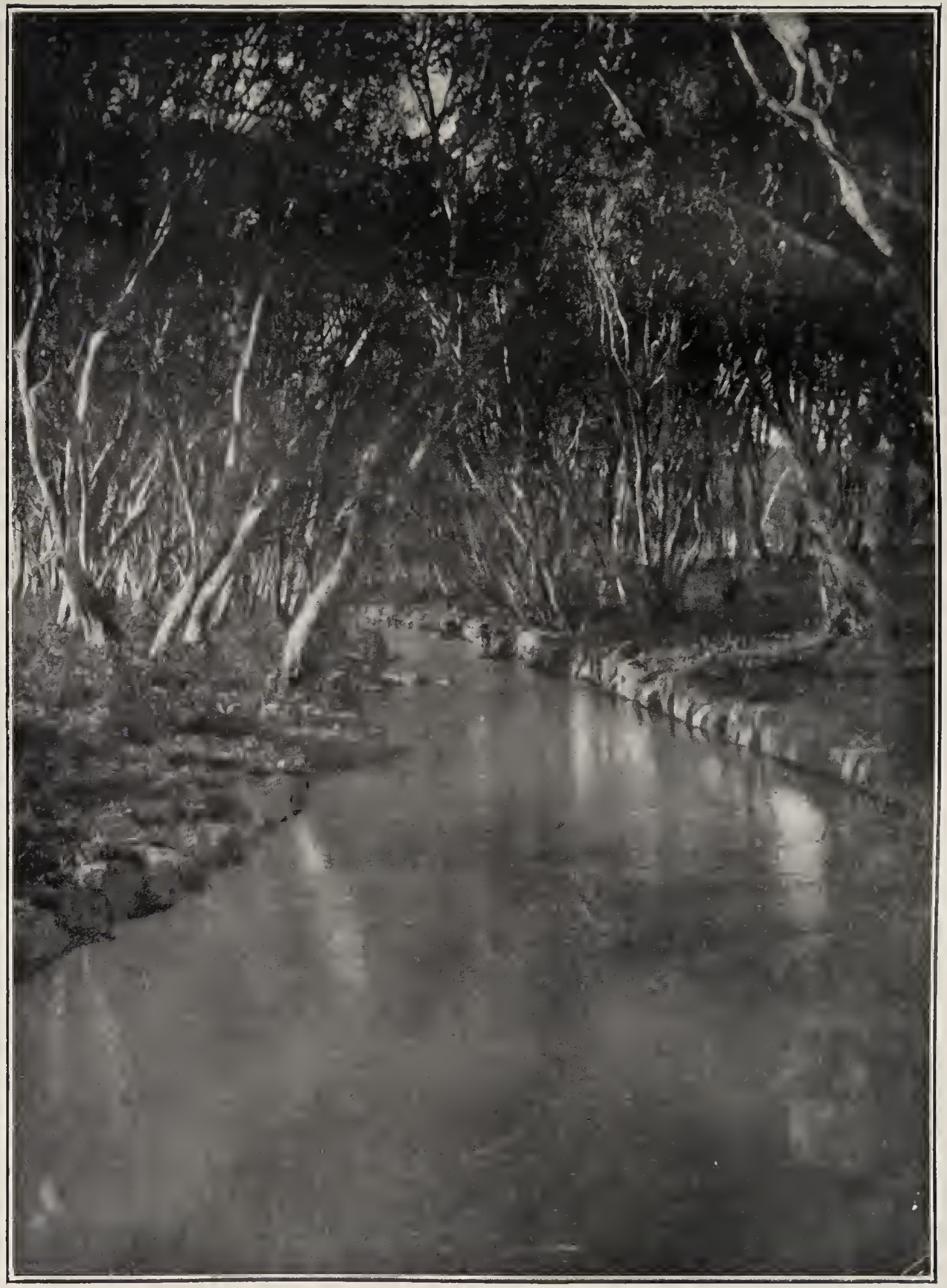
23.—Relaying a street gutter on the outskirts of Port Louis. Compare with No. 15.



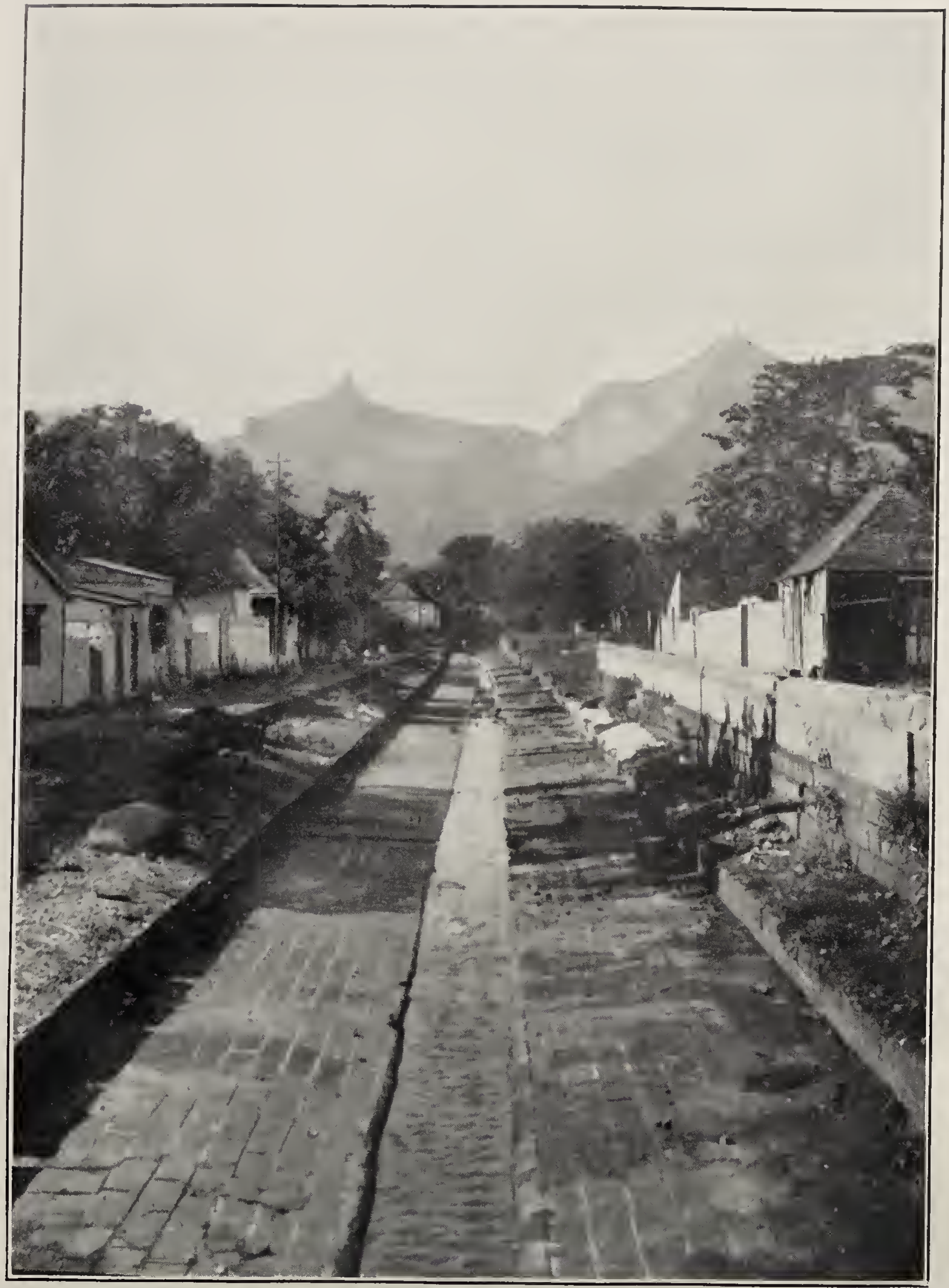
24.—Canalized stream, from the banks of which the shade trees had been removed contrary to order, thereby rendering it more suitable for the larvæ of *A. costalis.*



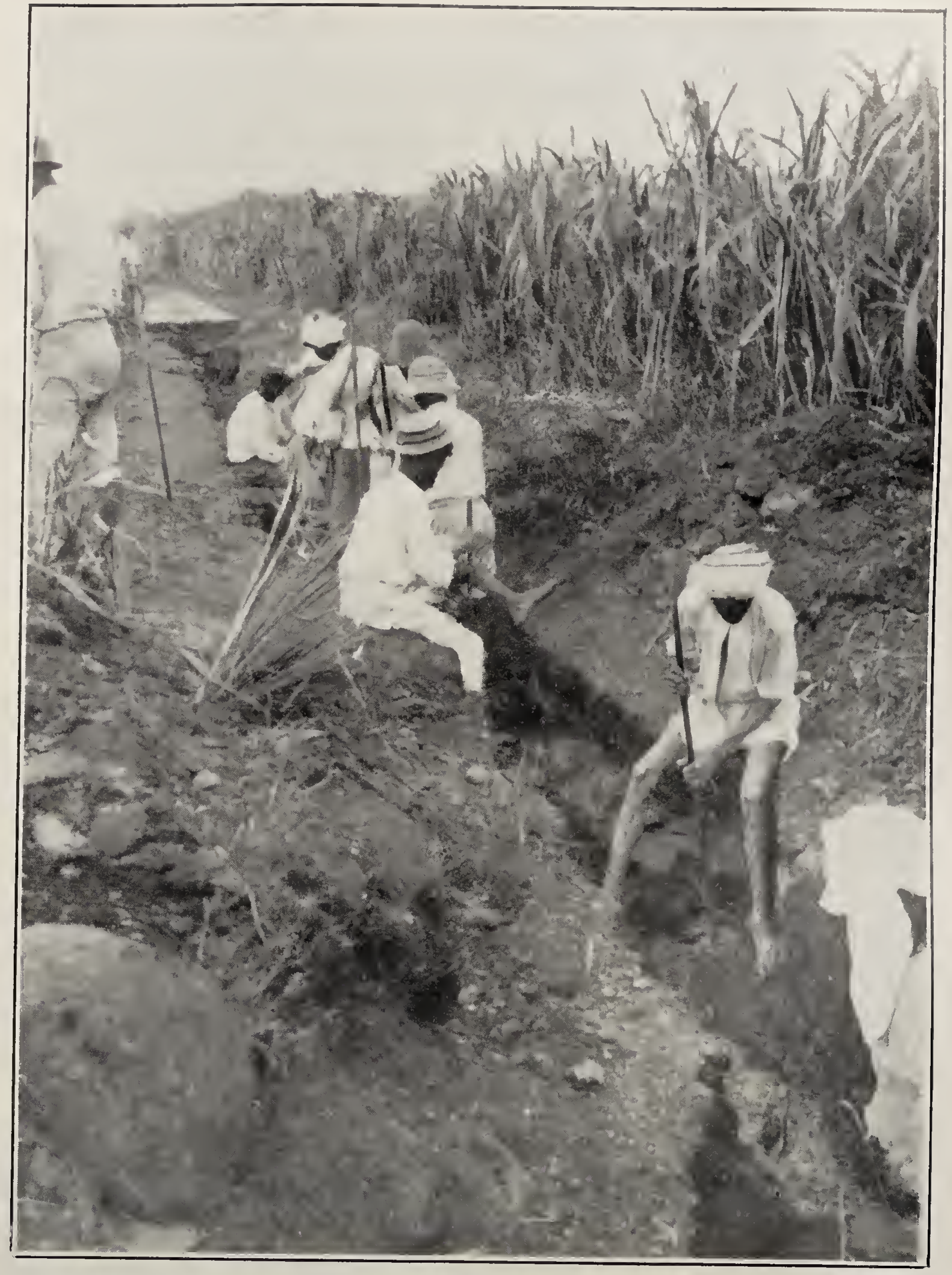
25.—A trained stream a portion of which is canalized with stone setts.



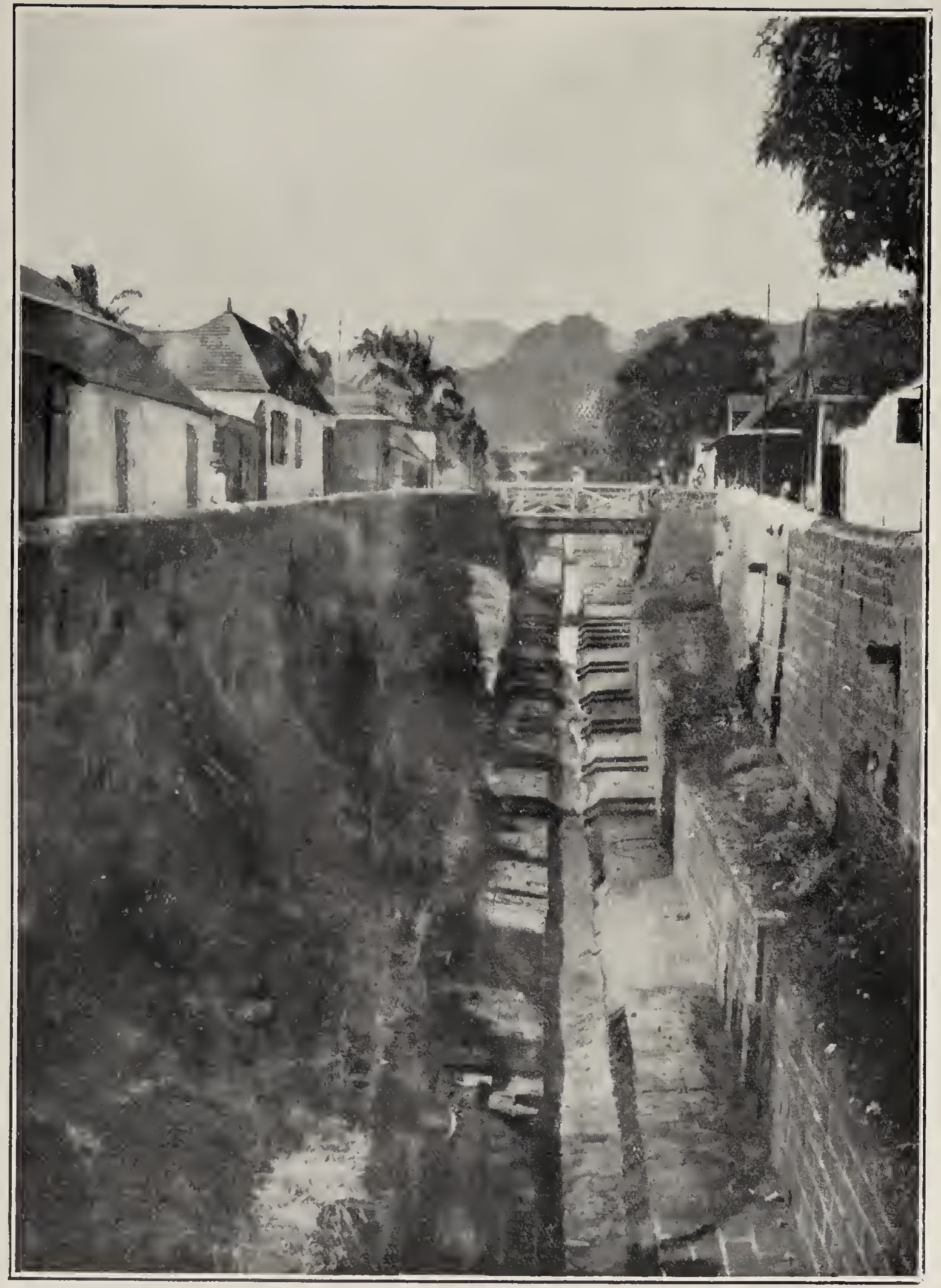
26.—Canalized stream shaded by Jamrosa trees (*Eugenia jamrosa*) and free from the larvæ of *A. costalis*.



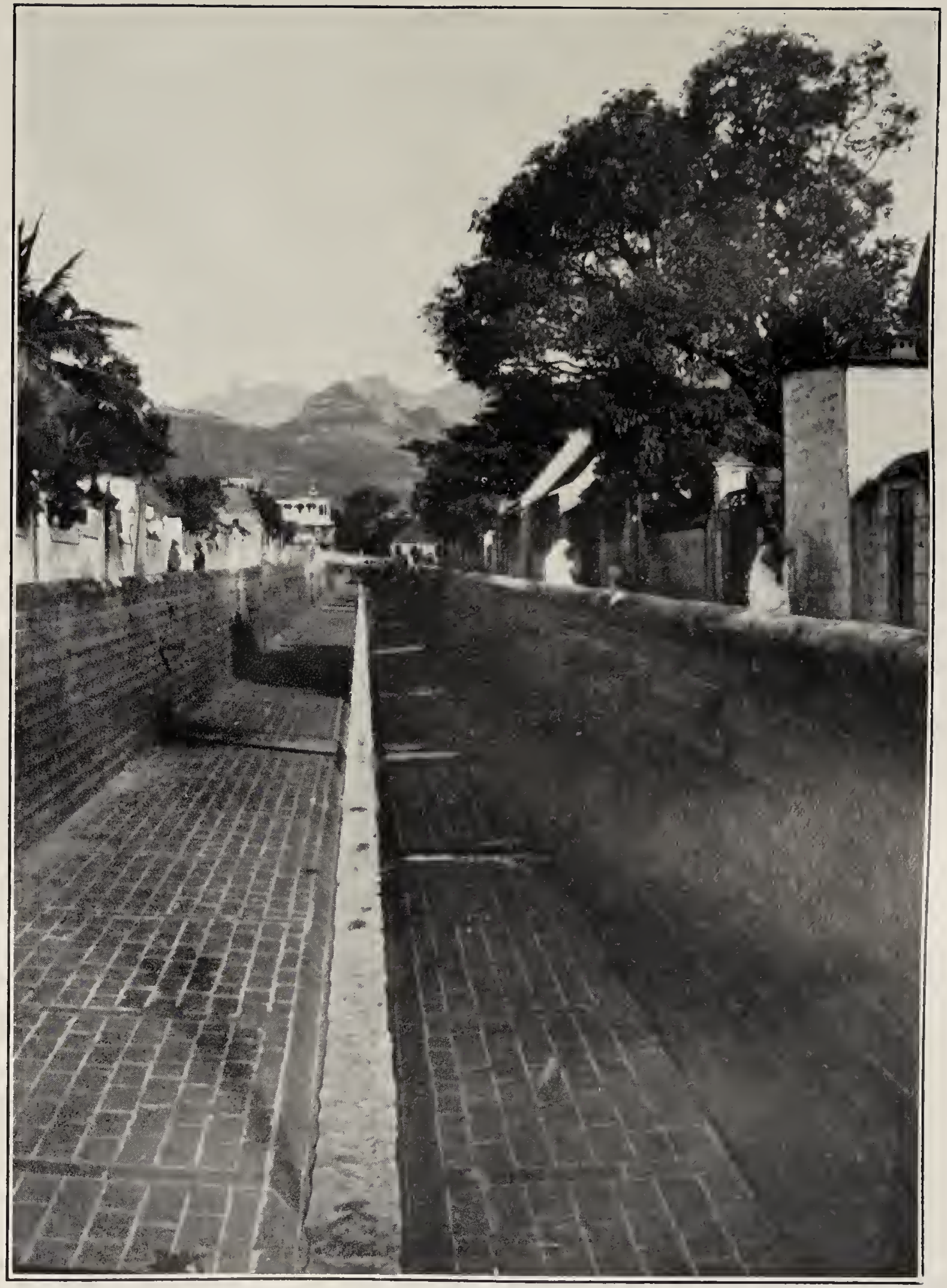
27.—One of the canalized streams traversing Port Louis.



28.—Drilling the rocky bed of a drainage channel for blasting operations in connection with anti-malarial work.

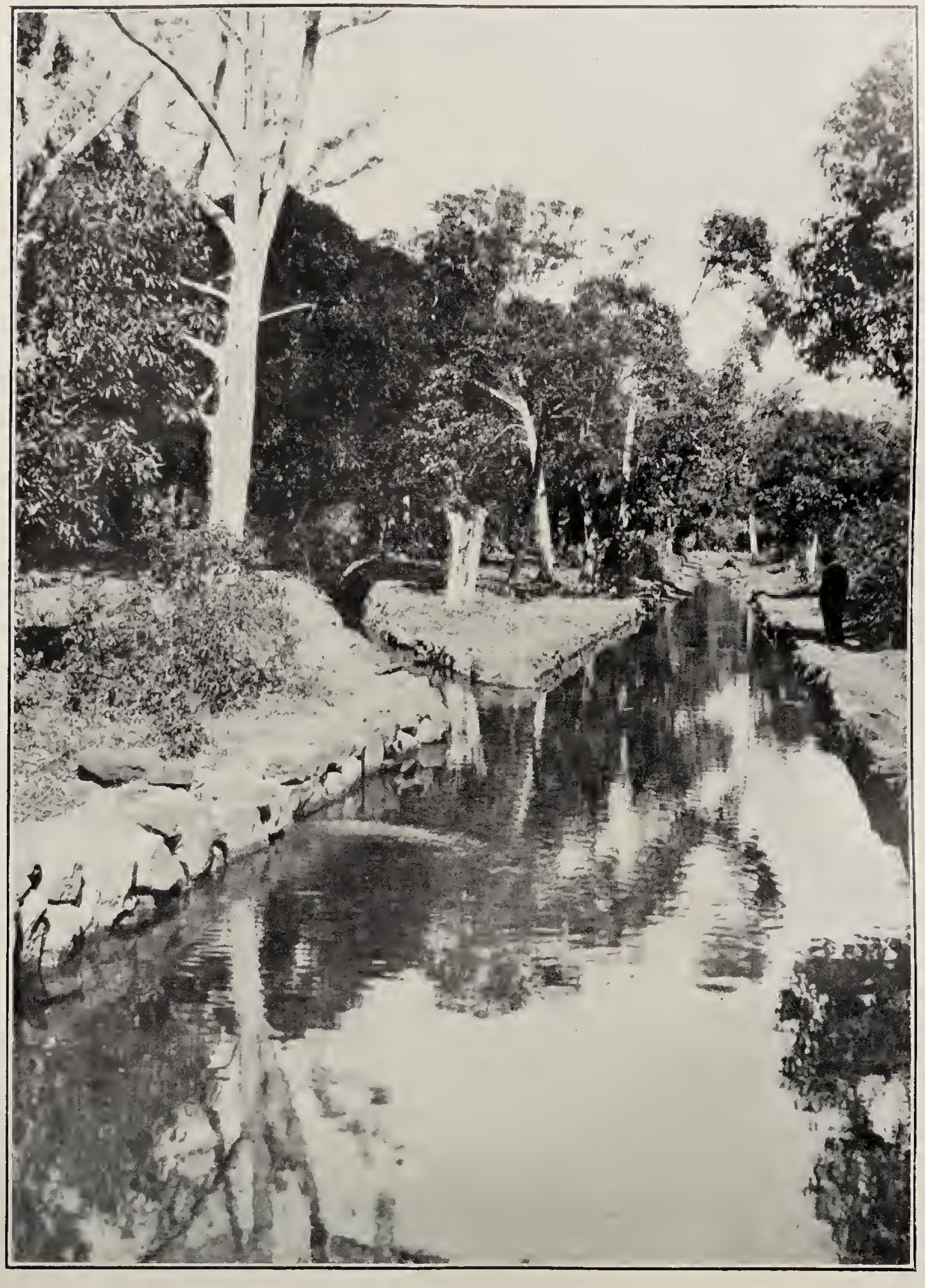


29.—Terraced form of canalization in one of the streams traversing Port Louis.



30.—Canalization of a water course traversing Port Louis. Note the excellent old Pavé, the side drains and the hill range in the background.

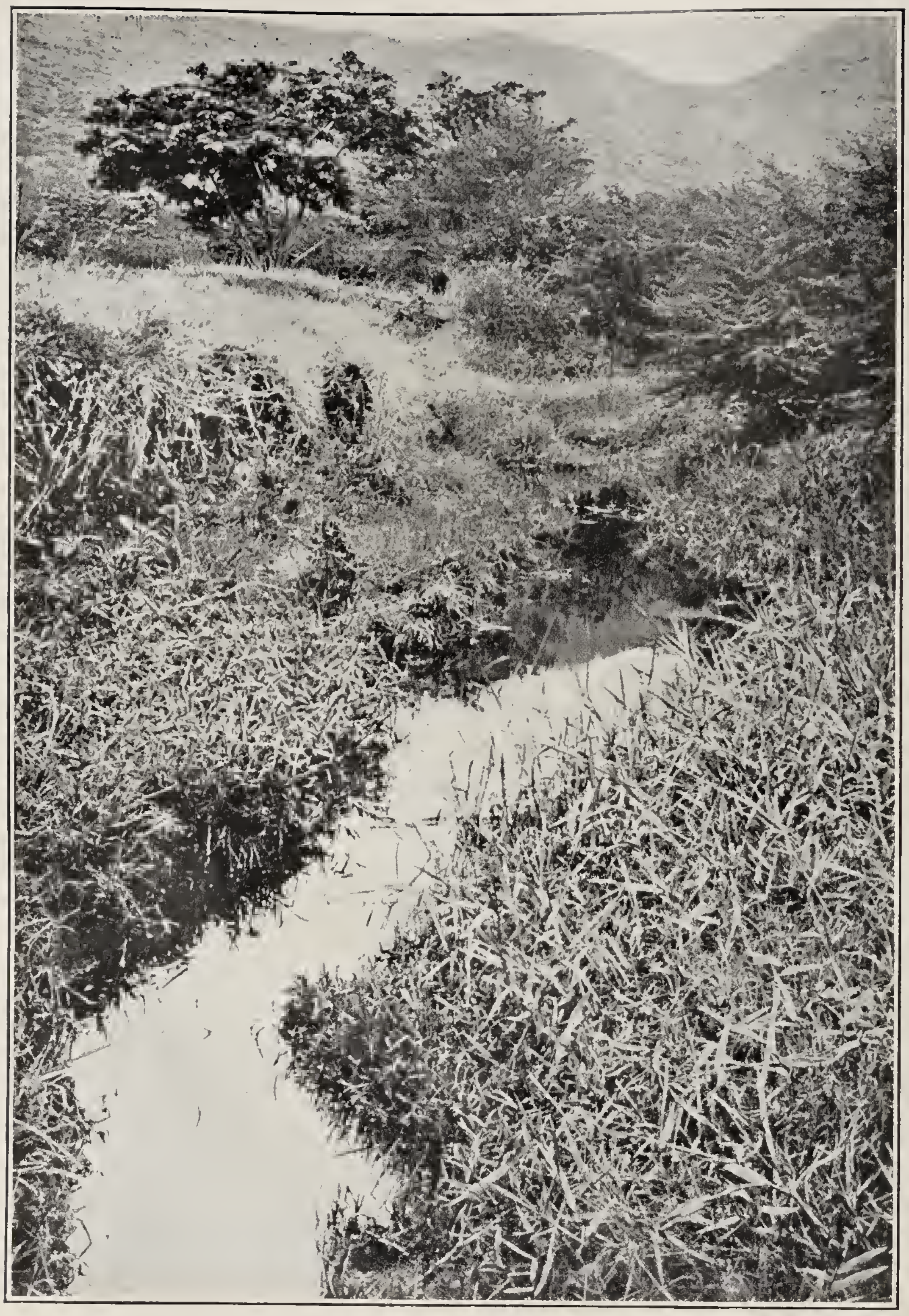
31. —Fields of sugar cane on what was formerly the Clairfond Swamp.



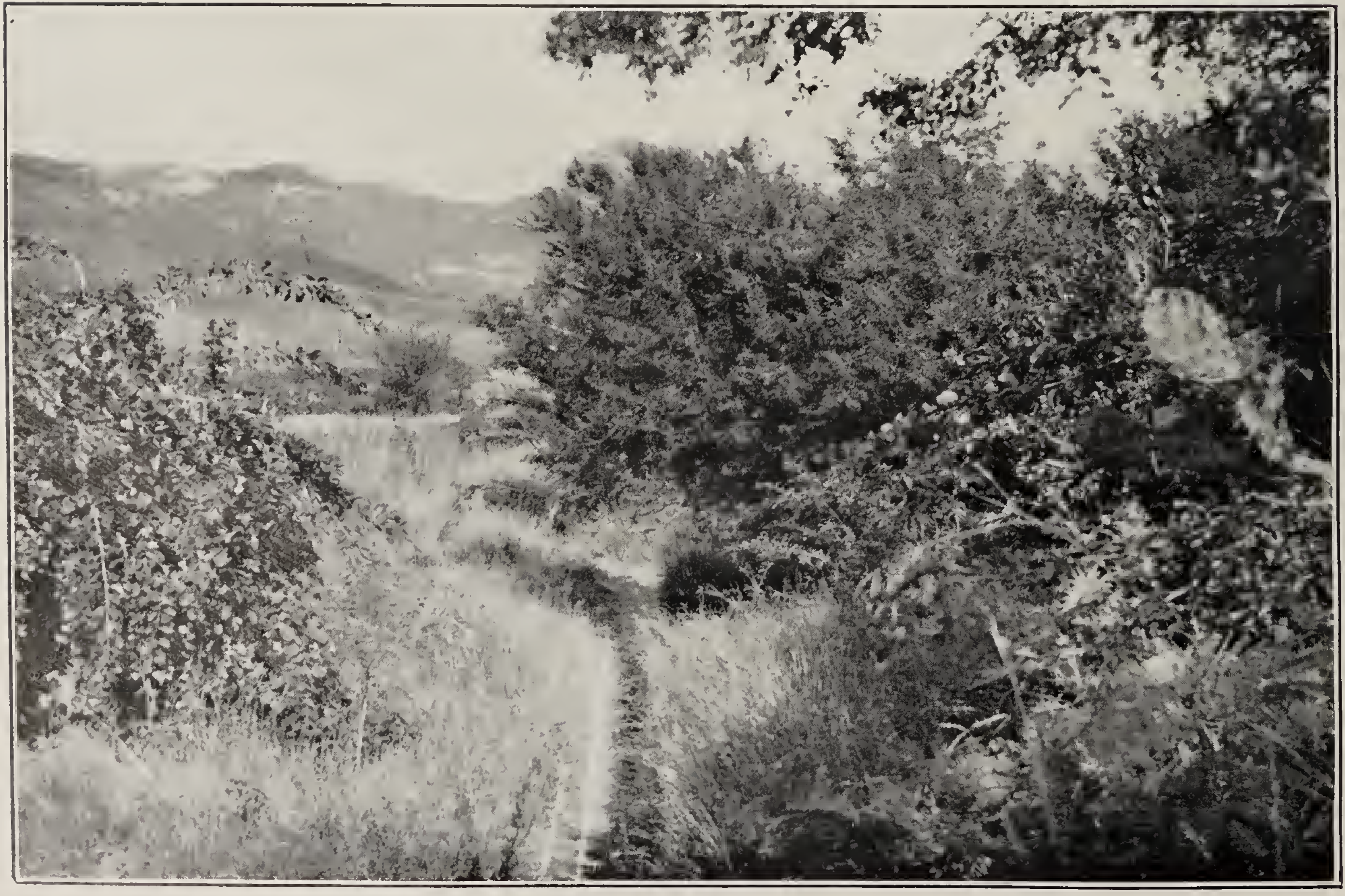
32.—Canalized banks of the River Dragon, Black River District.

33.—The canalized Rivière Sèche, District of Flacq. Drainage here led to great improvement.

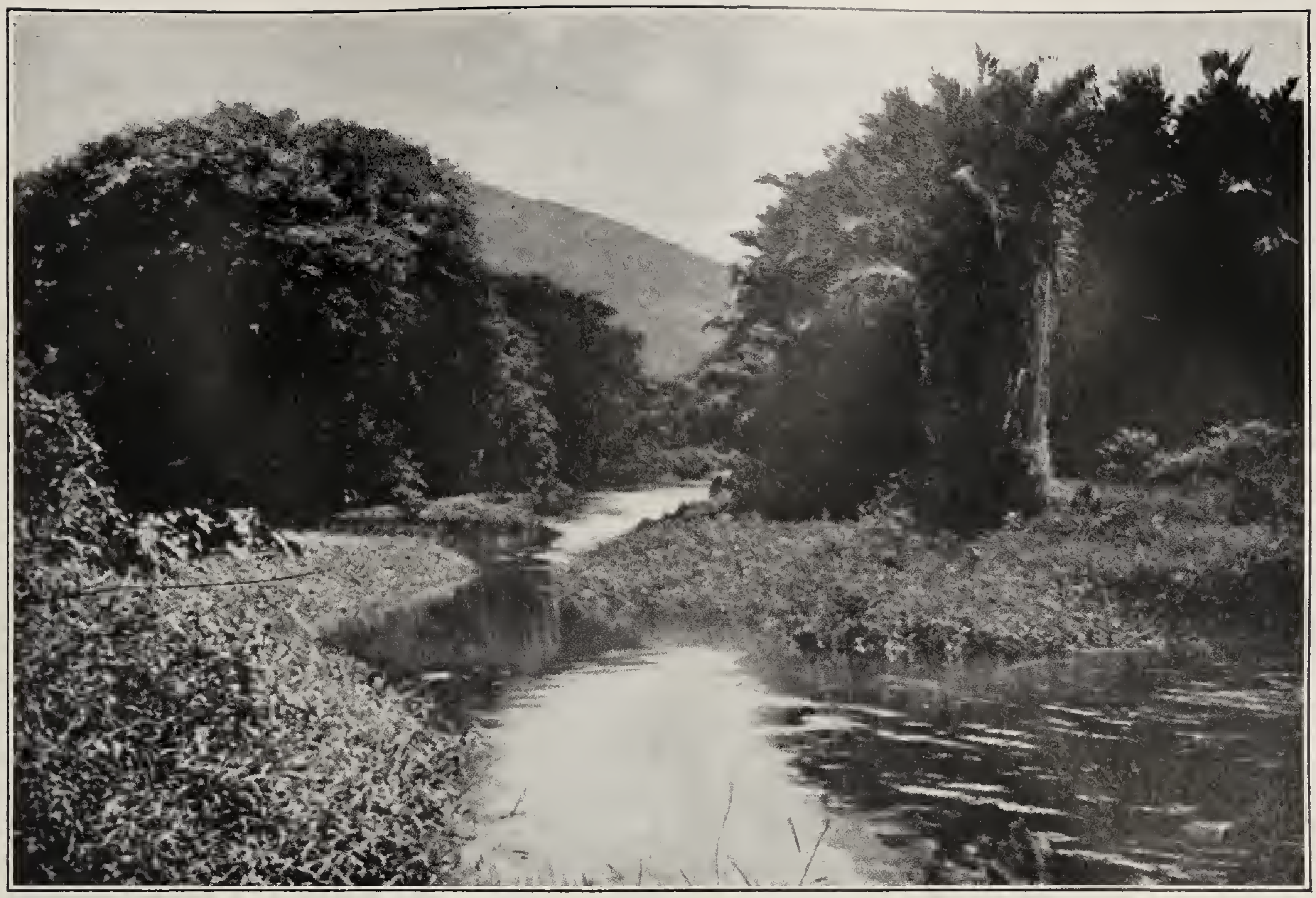
34.—Canalized bank of the Rivière des Creoles, St. Hubert Estate, Grand Port.



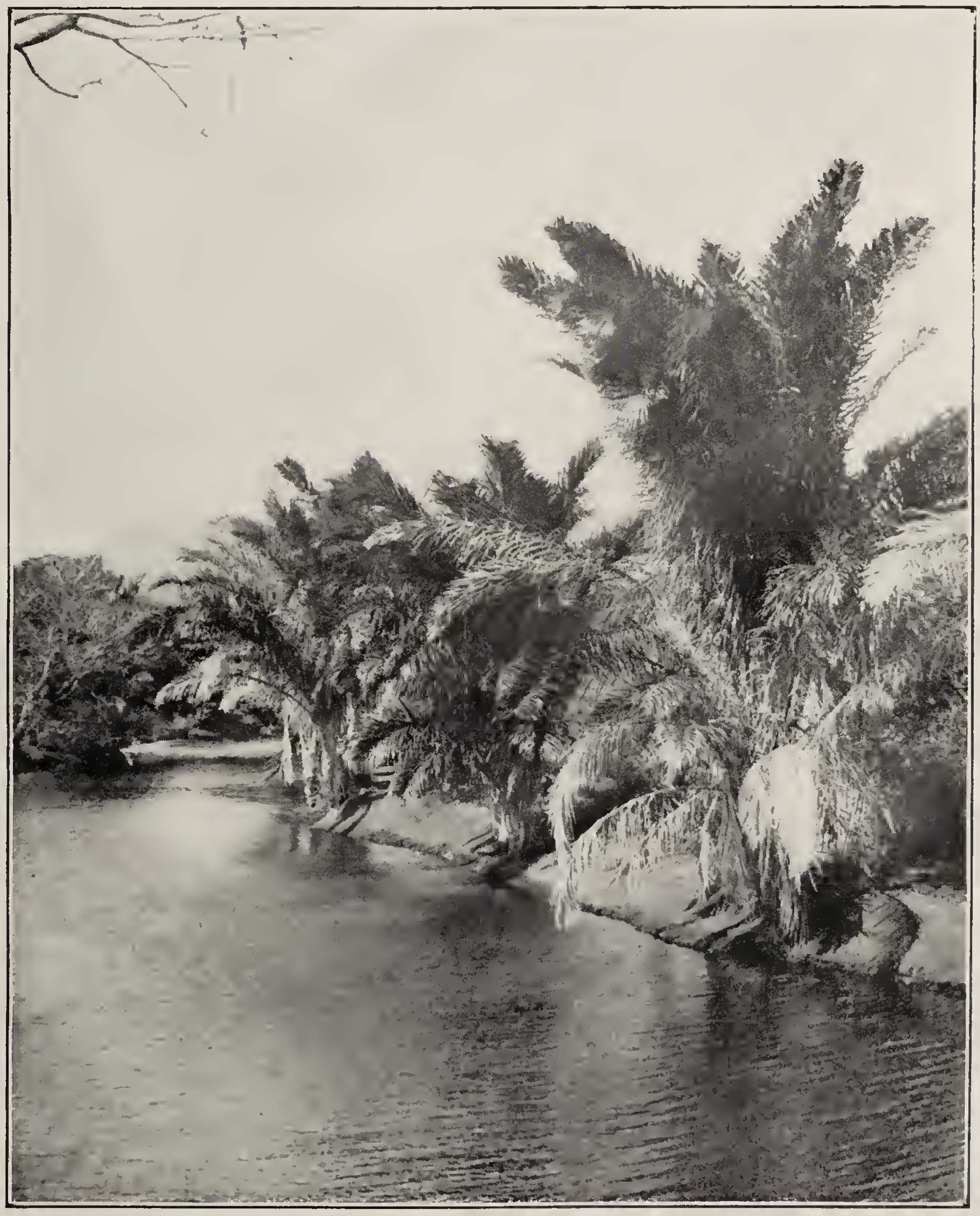
35.—La Paix stream at the time of Ross's and Fowler's visit, 1908.



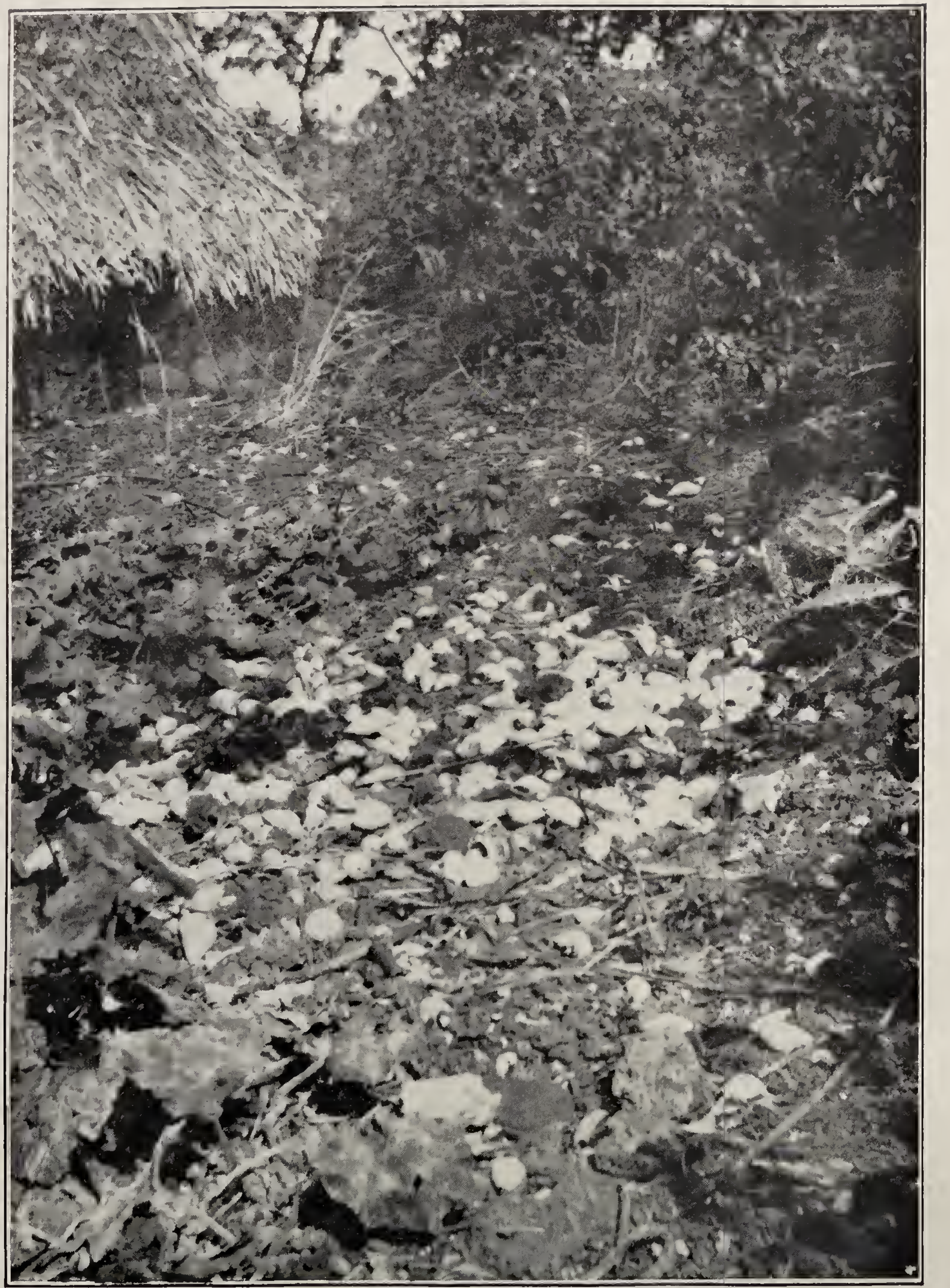
36.—La Paix stream. View taken from nearly the same spot at the present date as No. 35 during the dry season.



37.—Portion of Black River at the time of Ross's and Fowler's visit, 1908.



38.—View taken at the present time from nearly the same spot.

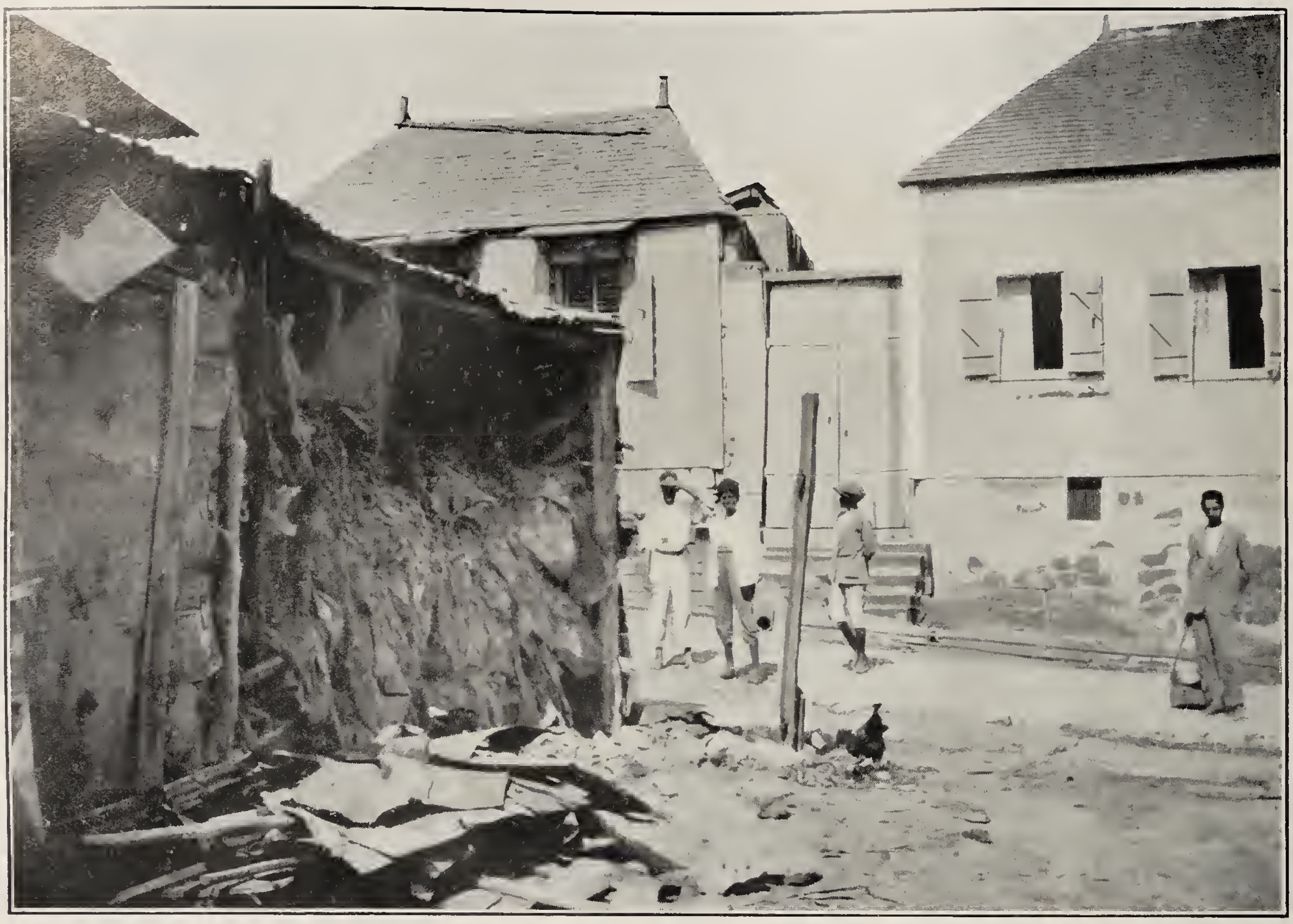


39.—Shells of a land snail forming breeding places for *Stegomyia*.

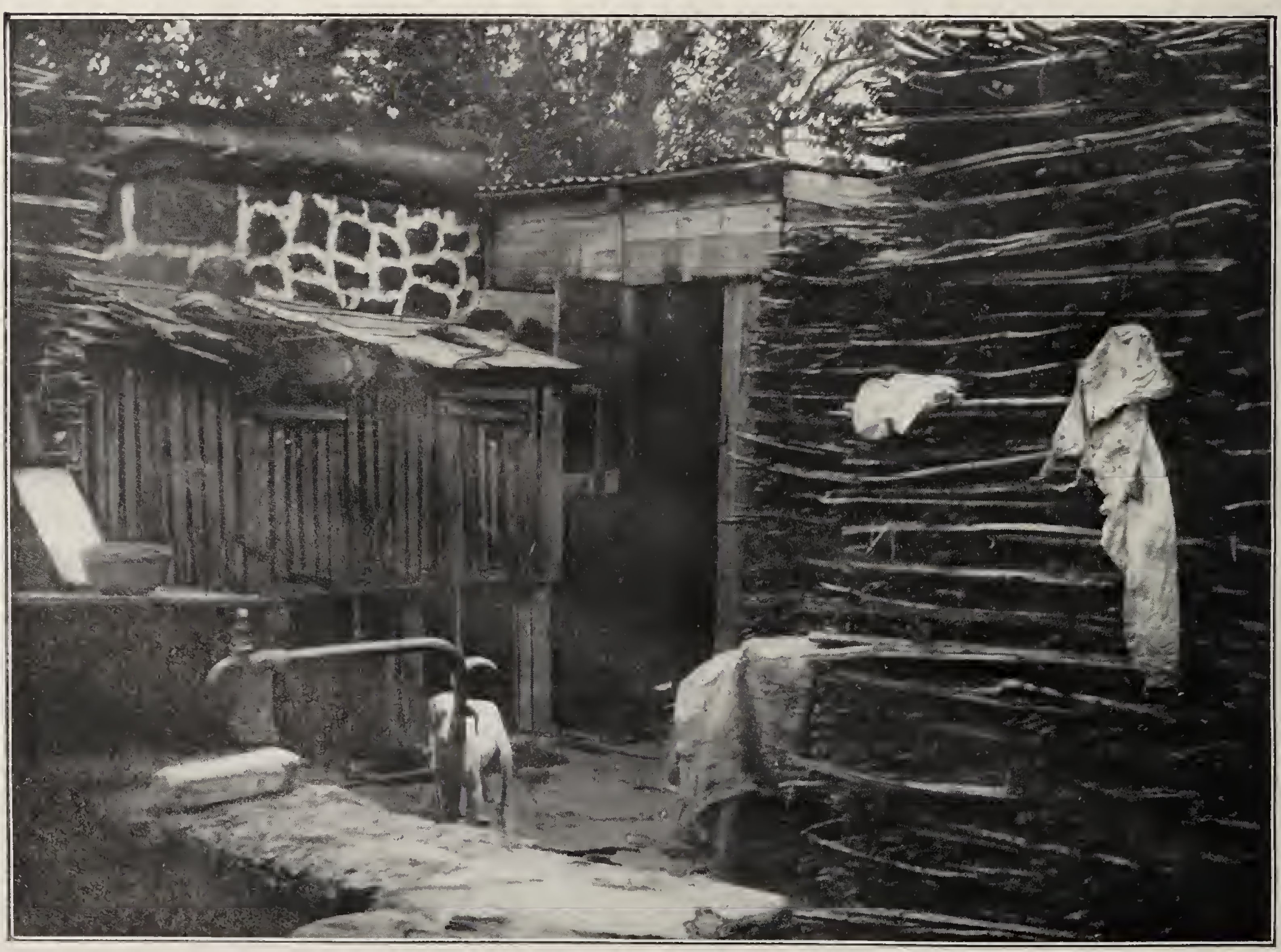
40.—Emptying a barrel which contained *Stegomyia* larvæ and pupæ.

41.—Notice enjoining the necessity of not interfering with sand in flower vases in the Cemetery near Mahebourg.

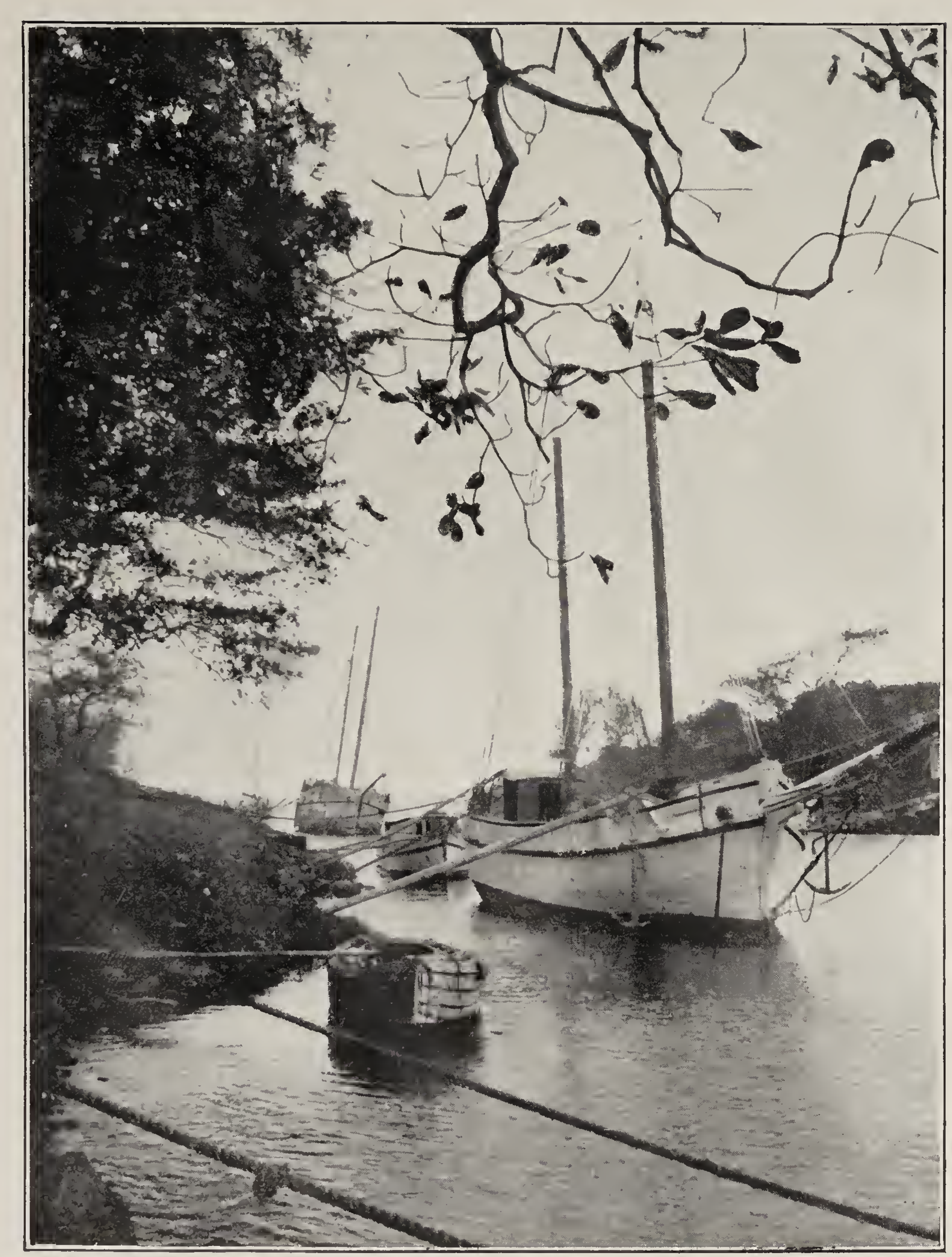
42.—Bamboos broken by hurricane, the stumps forming breeding places for *Stegomyia scutellaris.*



43.—A shed full of gunny bags, Port Louis ; these often harbour rats and fleas.

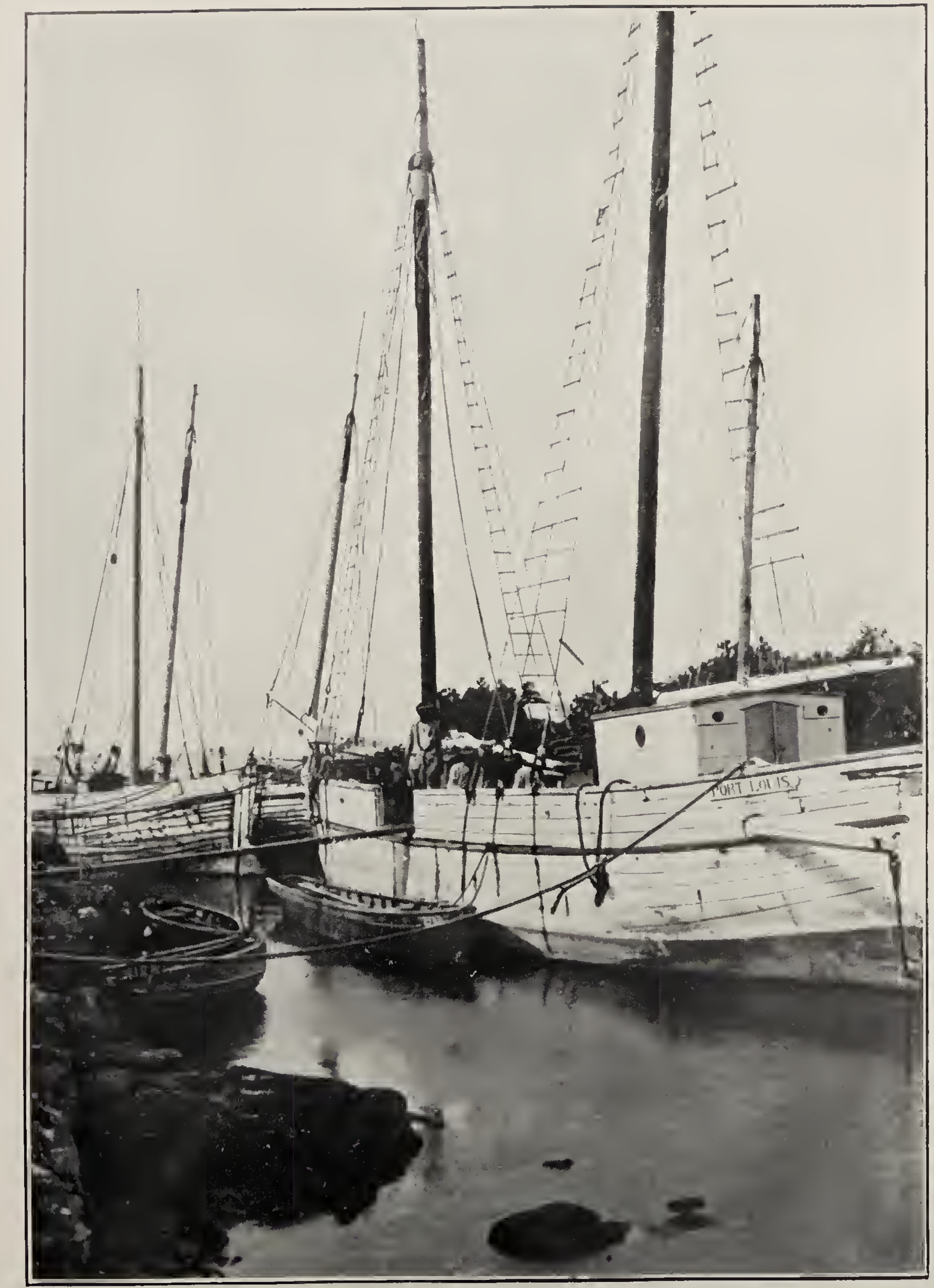


44.—Typical yard of a Chinaman's shop. The piles of wood afford harbourage for rats.

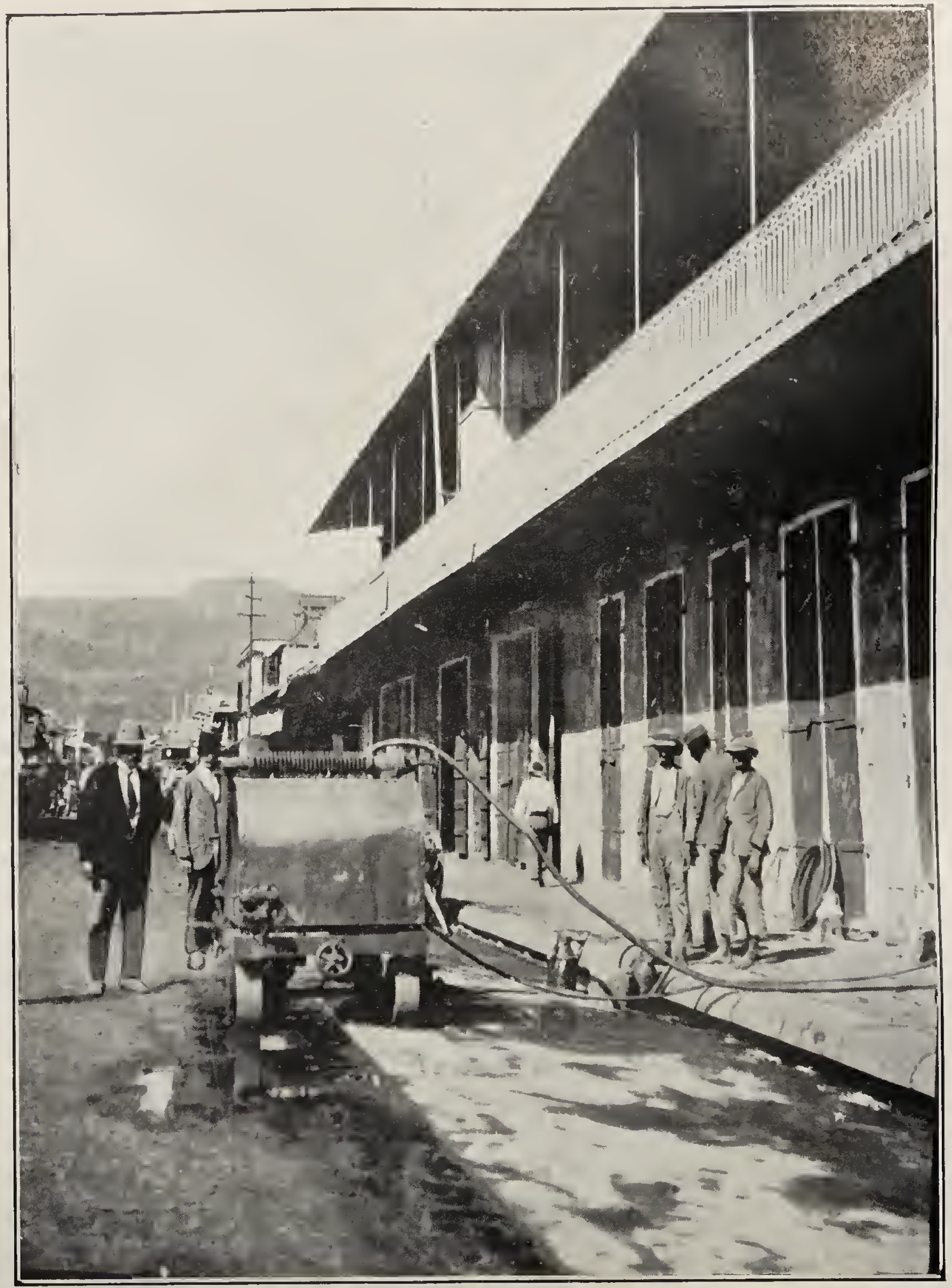


45.—Coasting vessels at Souillac, showing lack of precautions as regards the ingress and egress of rats.

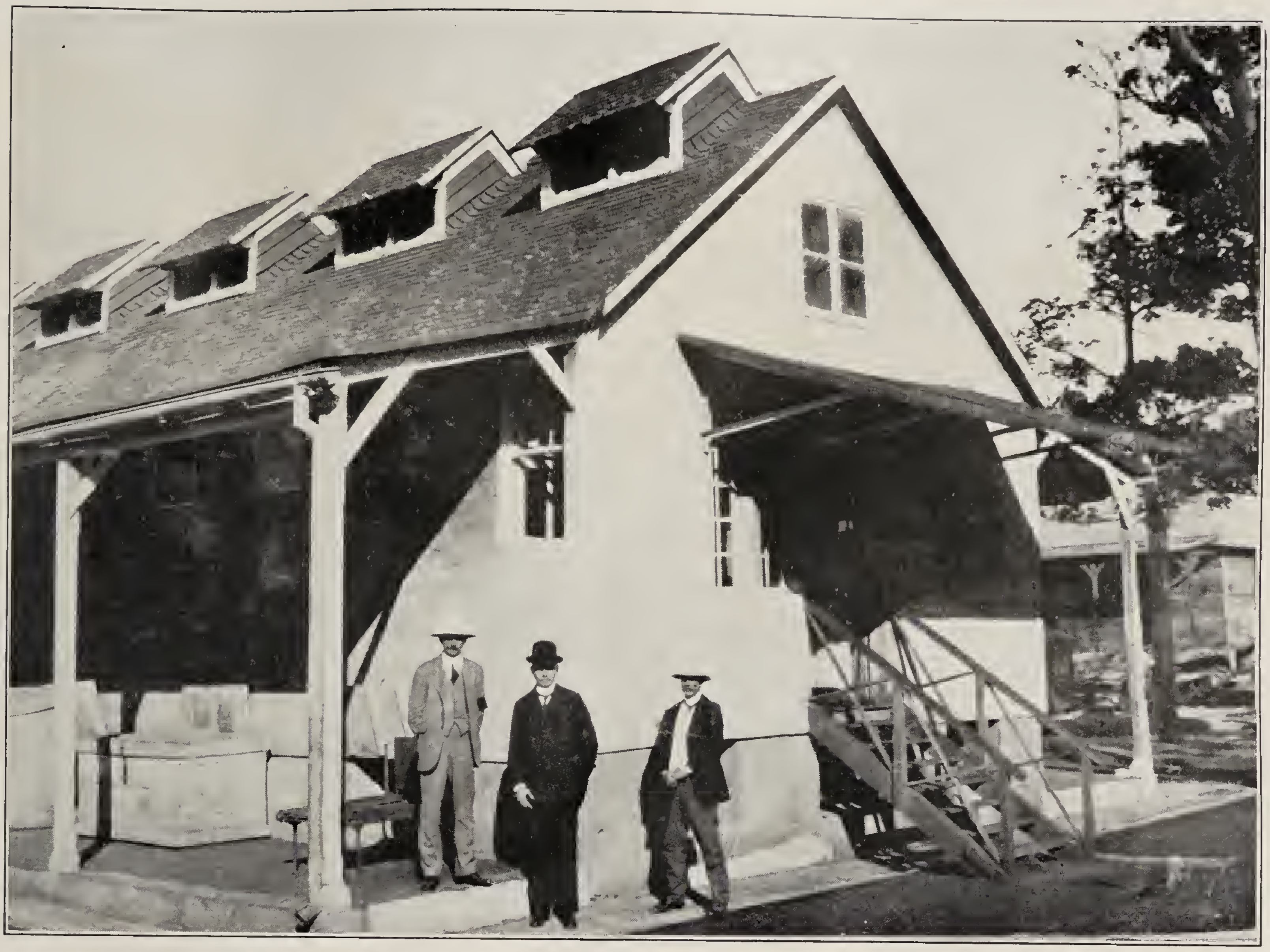
46.—Island schooners tied up to wharf at Port Louis, no precautions against plague.



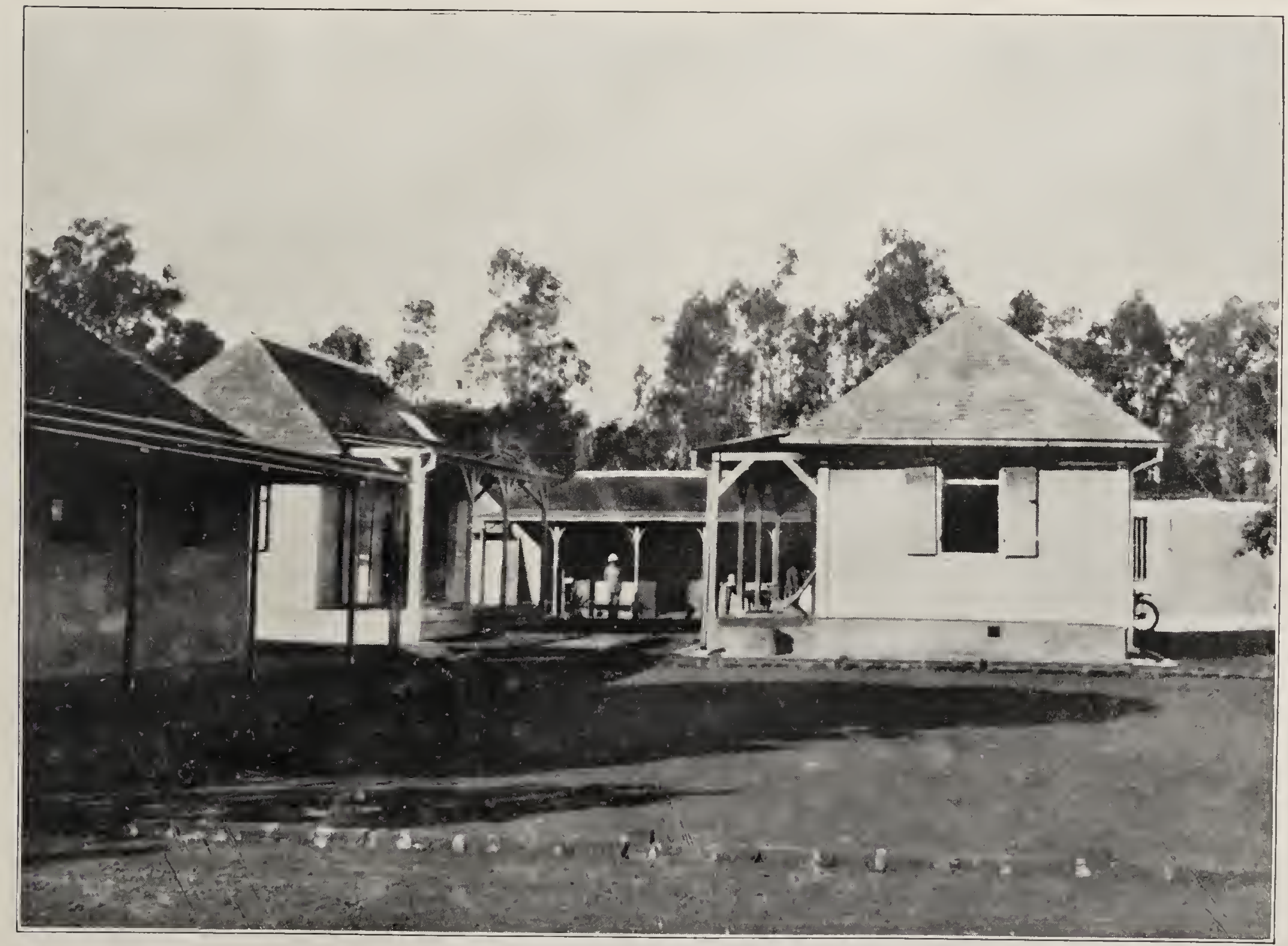
47.—Coasting vessels at Poste de Flacq. No precautions against plague.



48.—A Clayton apparatus at work during the plague epidemic in Port Louis.



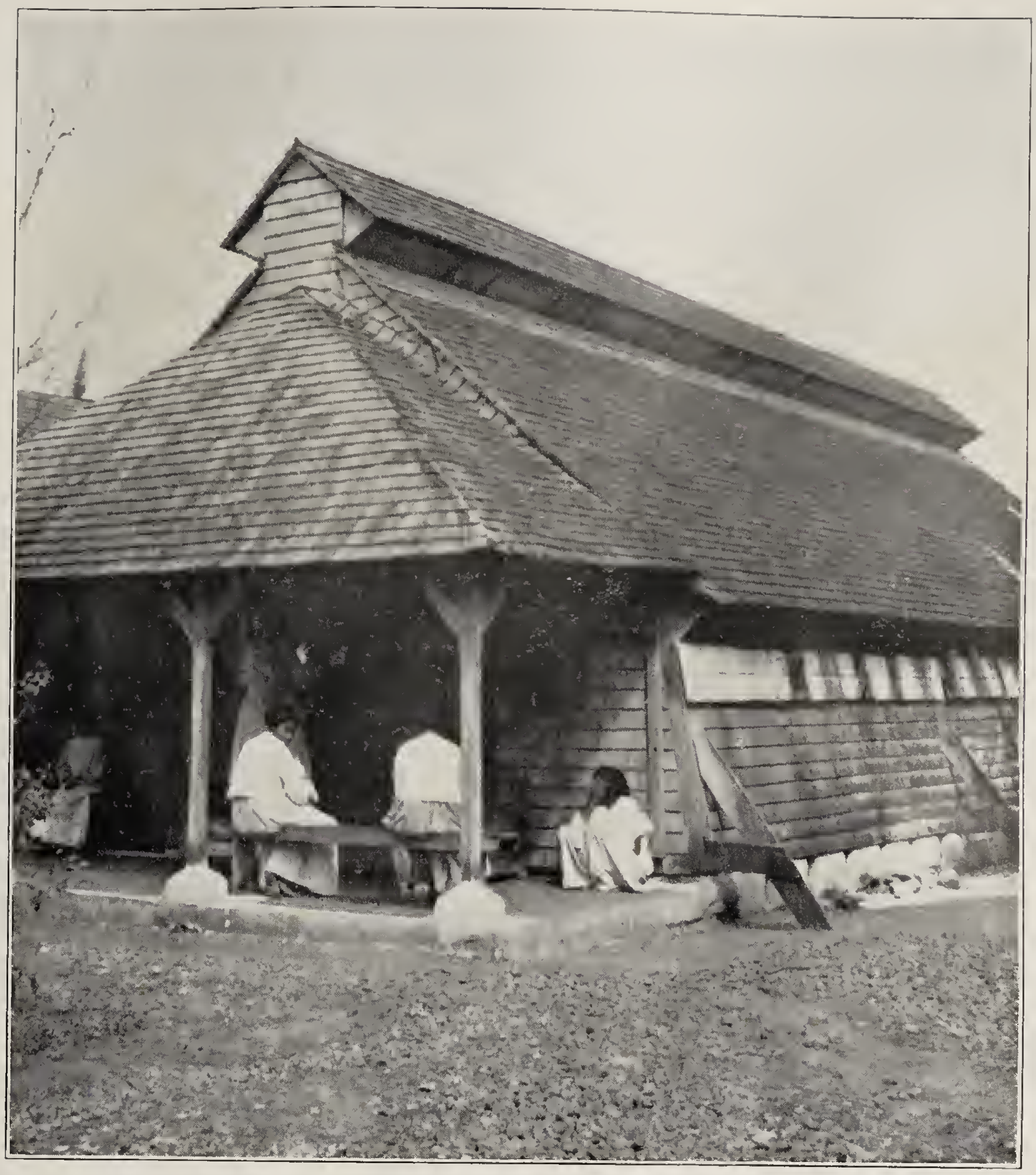
49.—Ward of Moka Hospital; the best of the Government Hospitals in Mauritius.



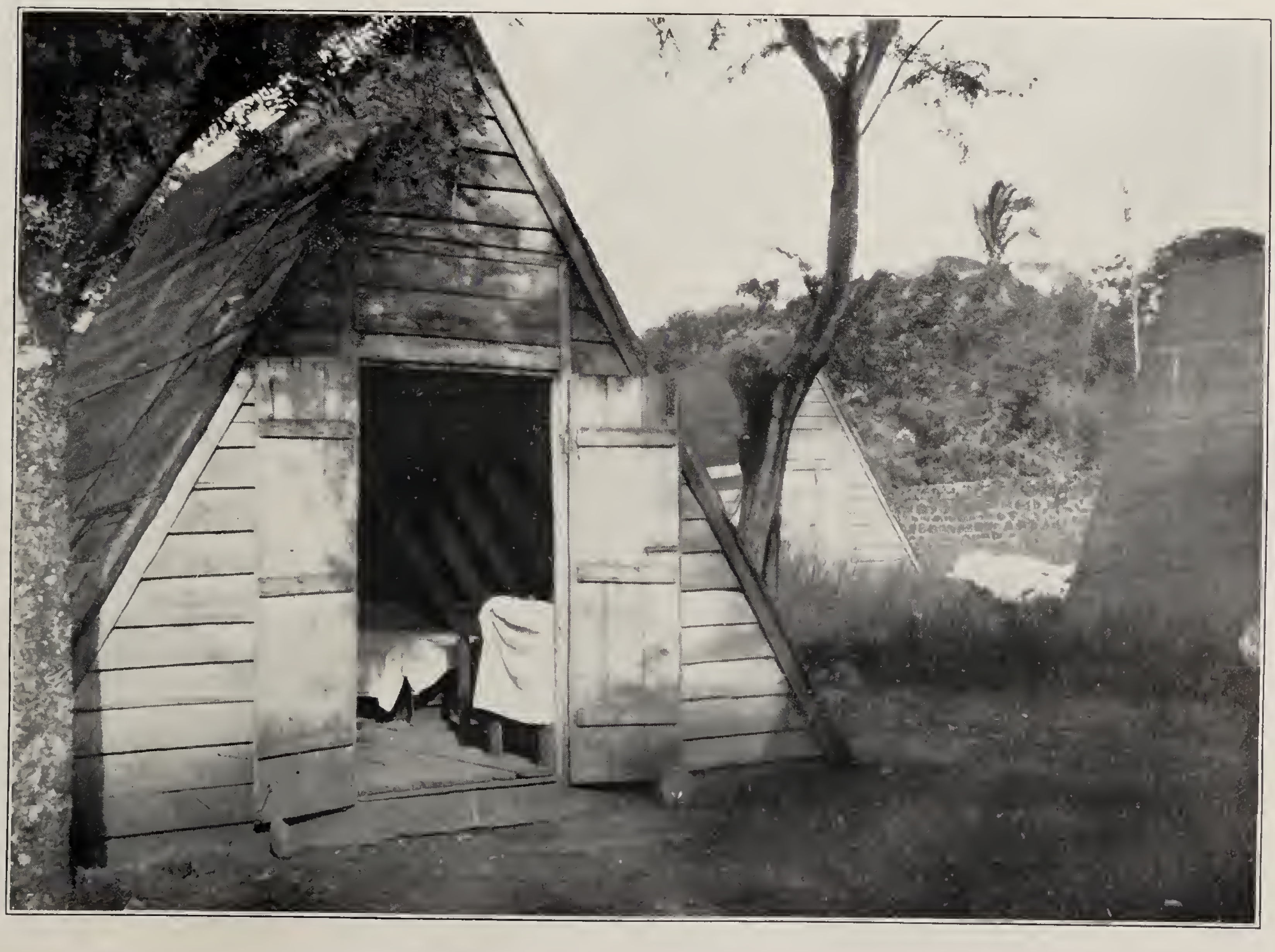
50.—General View of Moka Hospital.

51.—Type of Government Dispensary. These Dispensaries are often combined with the Civil Status Offices.

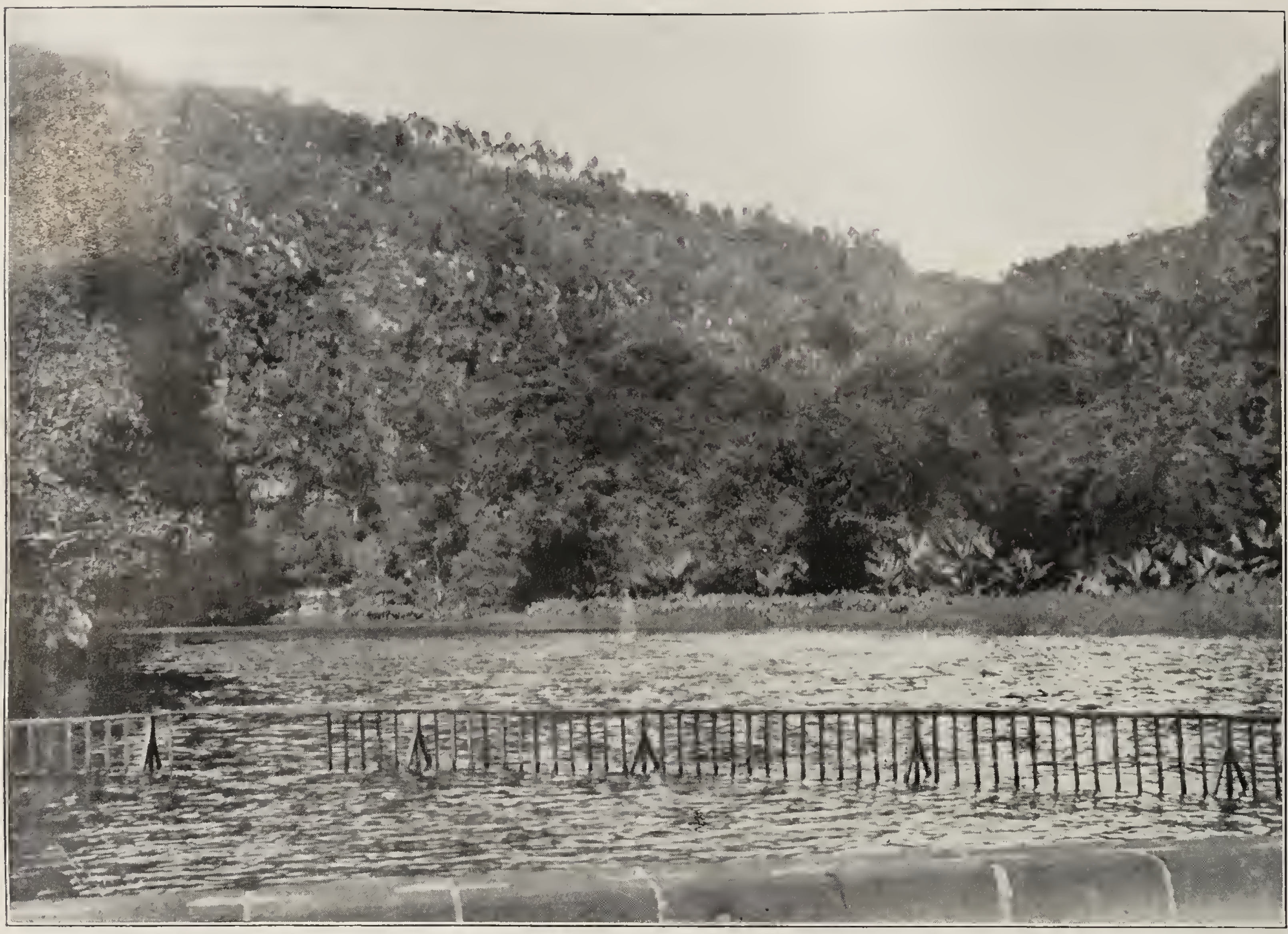
52.—A Sugar Estate Crèche where the children are looked after while their mothers are at work.



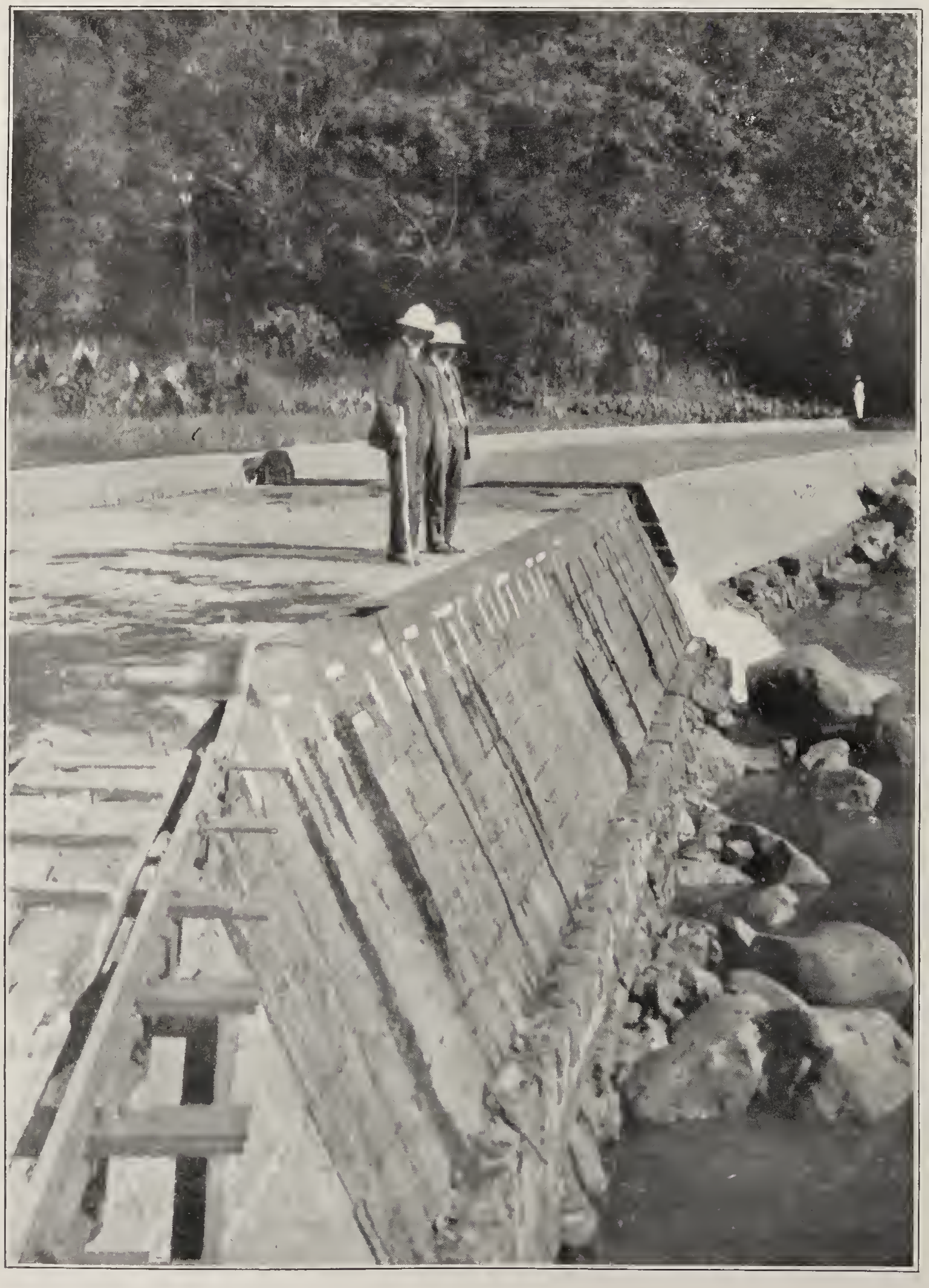
53.—Ward at Mahebourg Hospital. Note small windows closed by shutters and ridge ventilation. The type is distinctly unsuitable.



54.—Triangular isolation hut. This is the common type of isolation ward in Mauritius

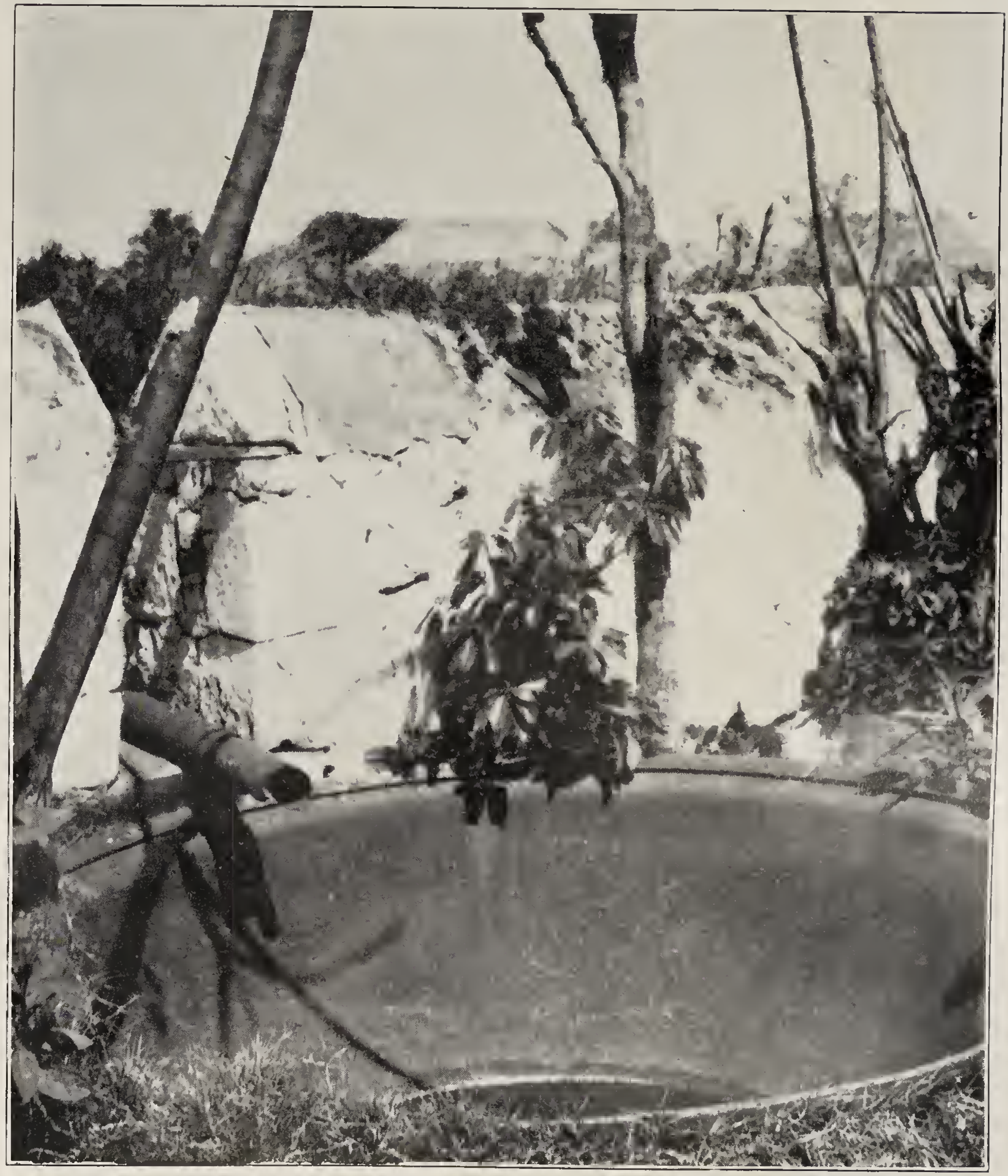


55.—Impounded water of Grand River, N.W., forming a supply for Port Louis. The fence removes gross impurities. Note reeds which probably harbour the snail hosts of human schistosomes.

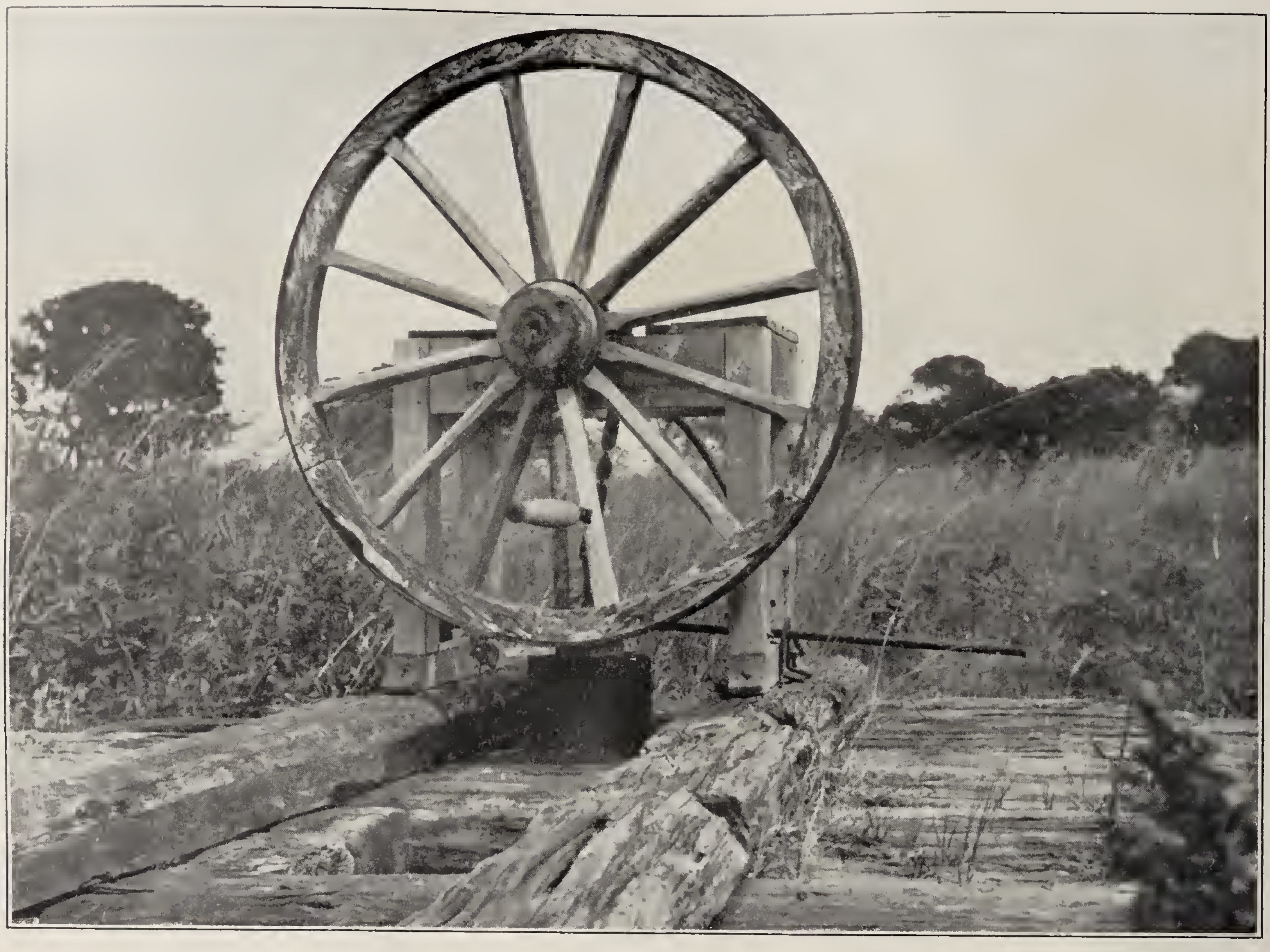


56.—Dam across Grand River, N.W., impounding water supply for Port Louis.

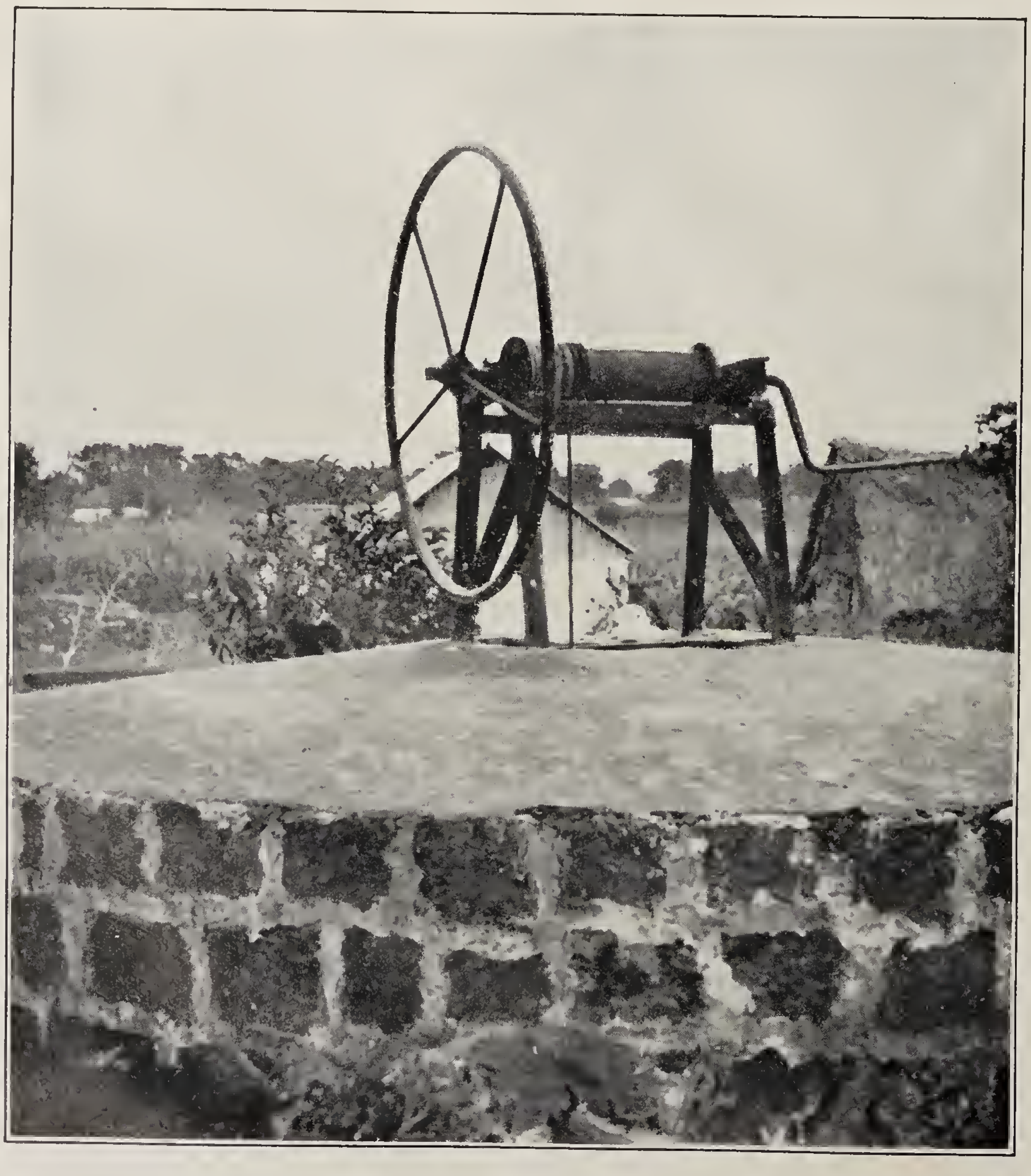
57.—Eaux Bonnes Springs, Bambous, Black River District.



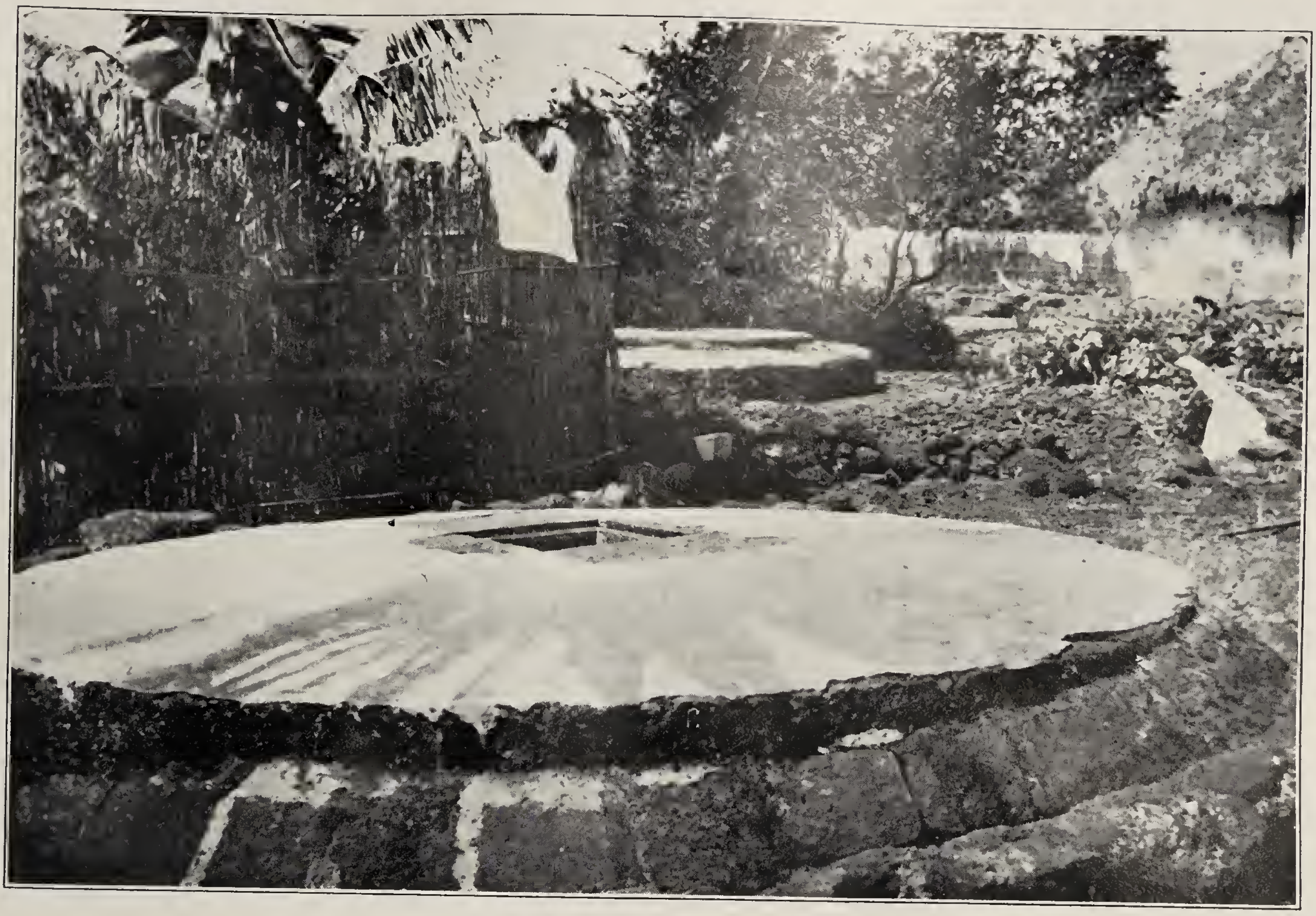
58.—Method of storing drinking water at a sugar estate in Pamplemousses.



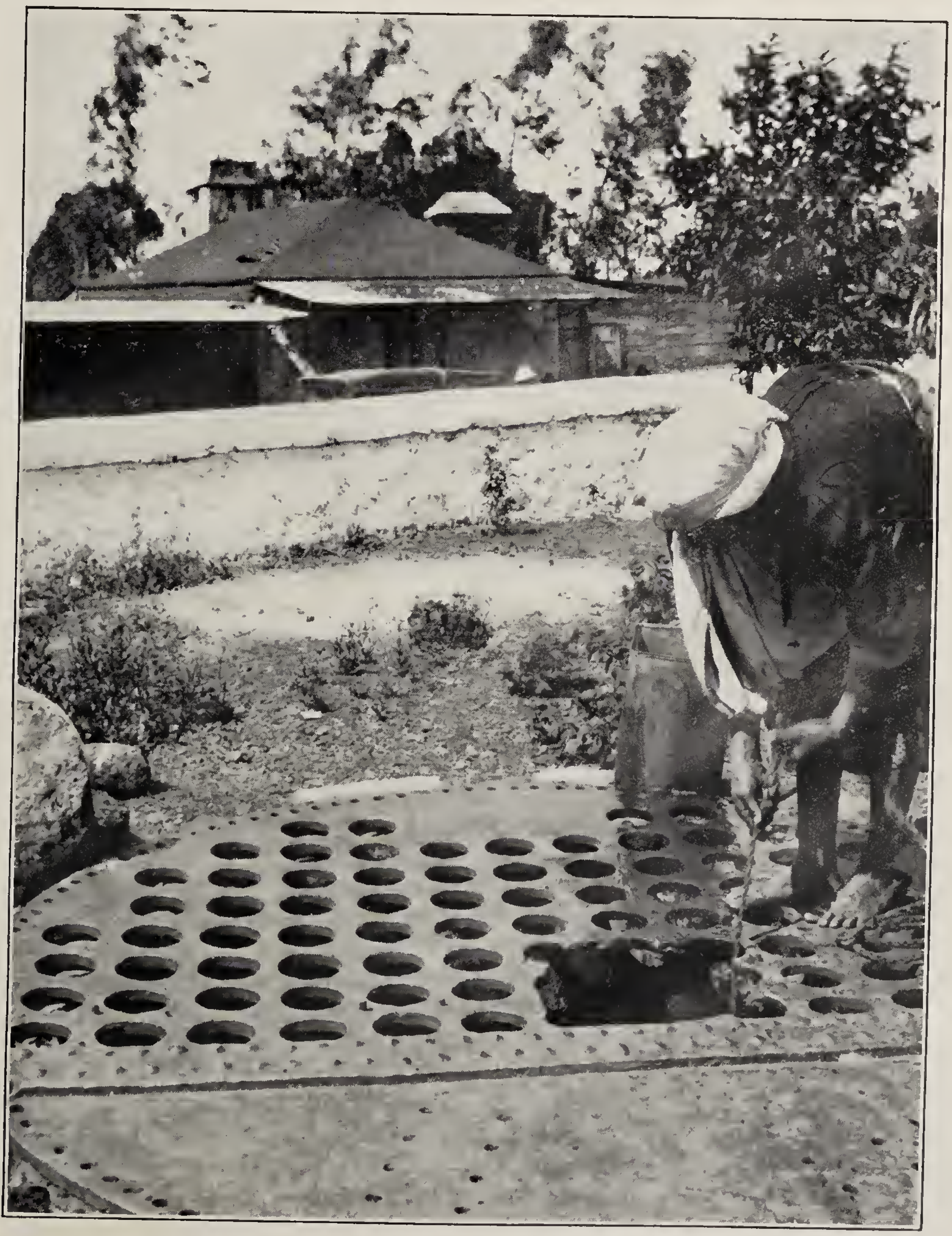
59.—Well with wooden cover in bad condition, and improvised windlass.



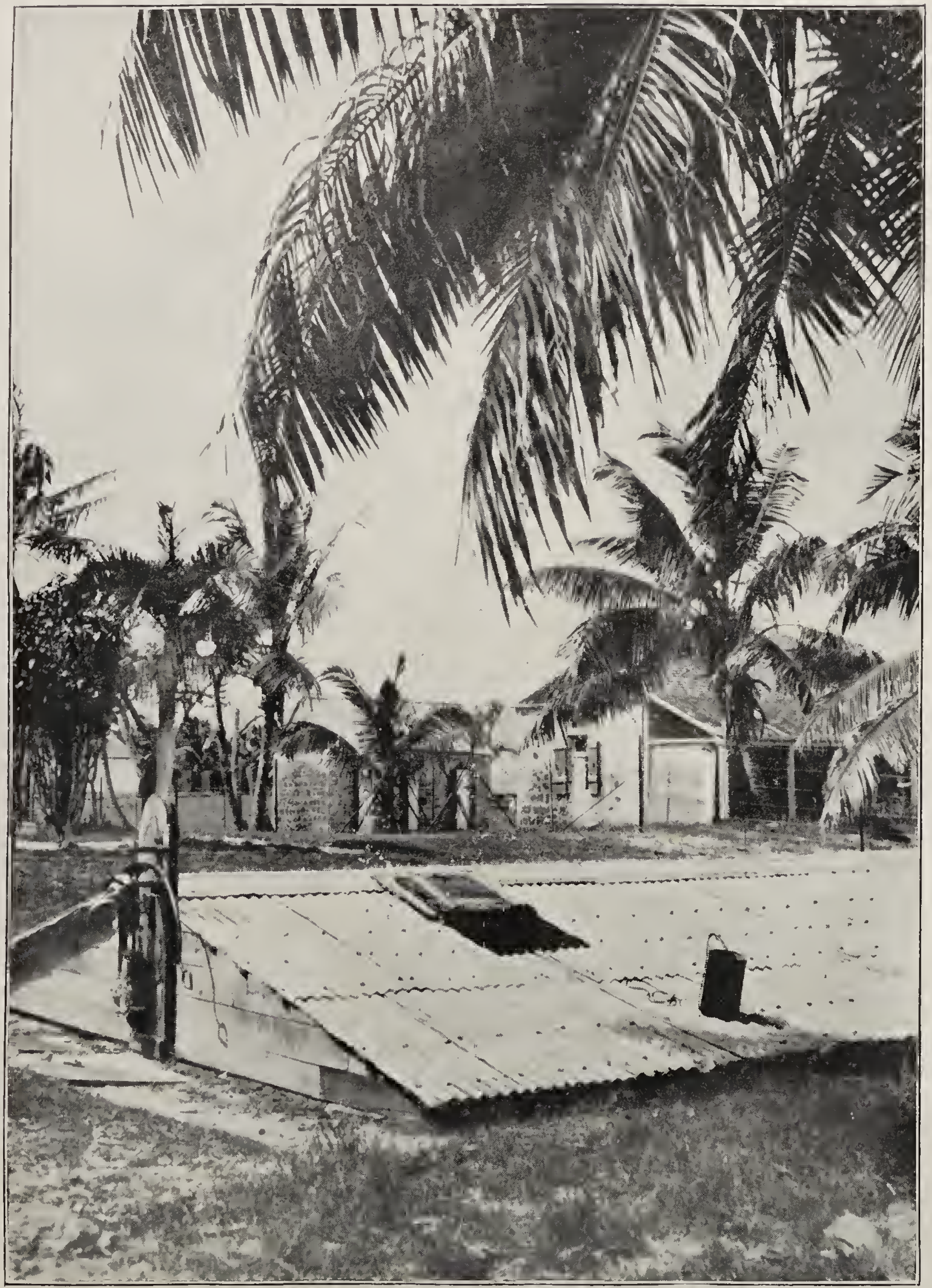
60.—Well head, properly covered, provided with windlass. Opening in cover not protected.



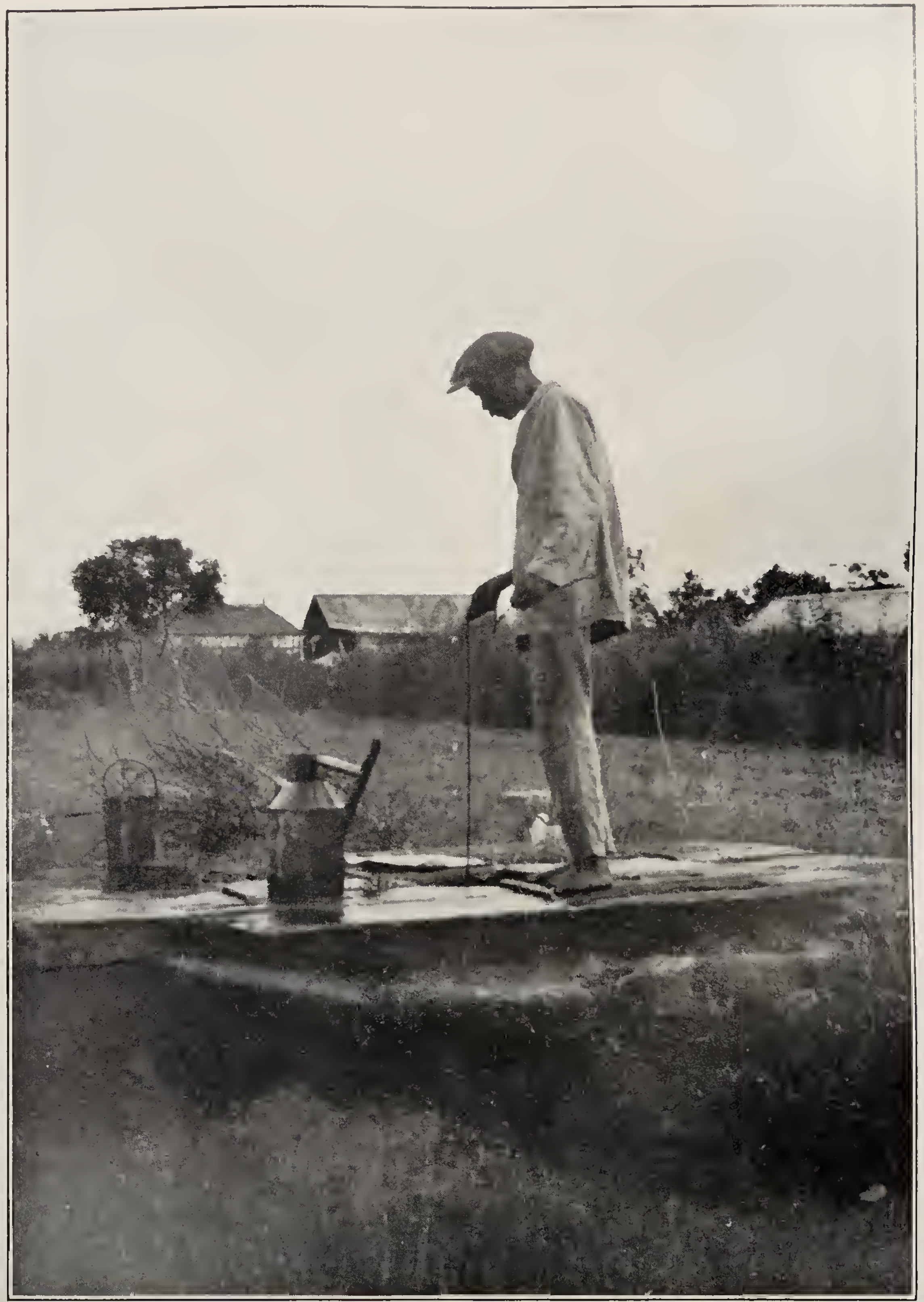
61.—Well head properly filled in, but opening unguarded. Sugar estate, Moka.



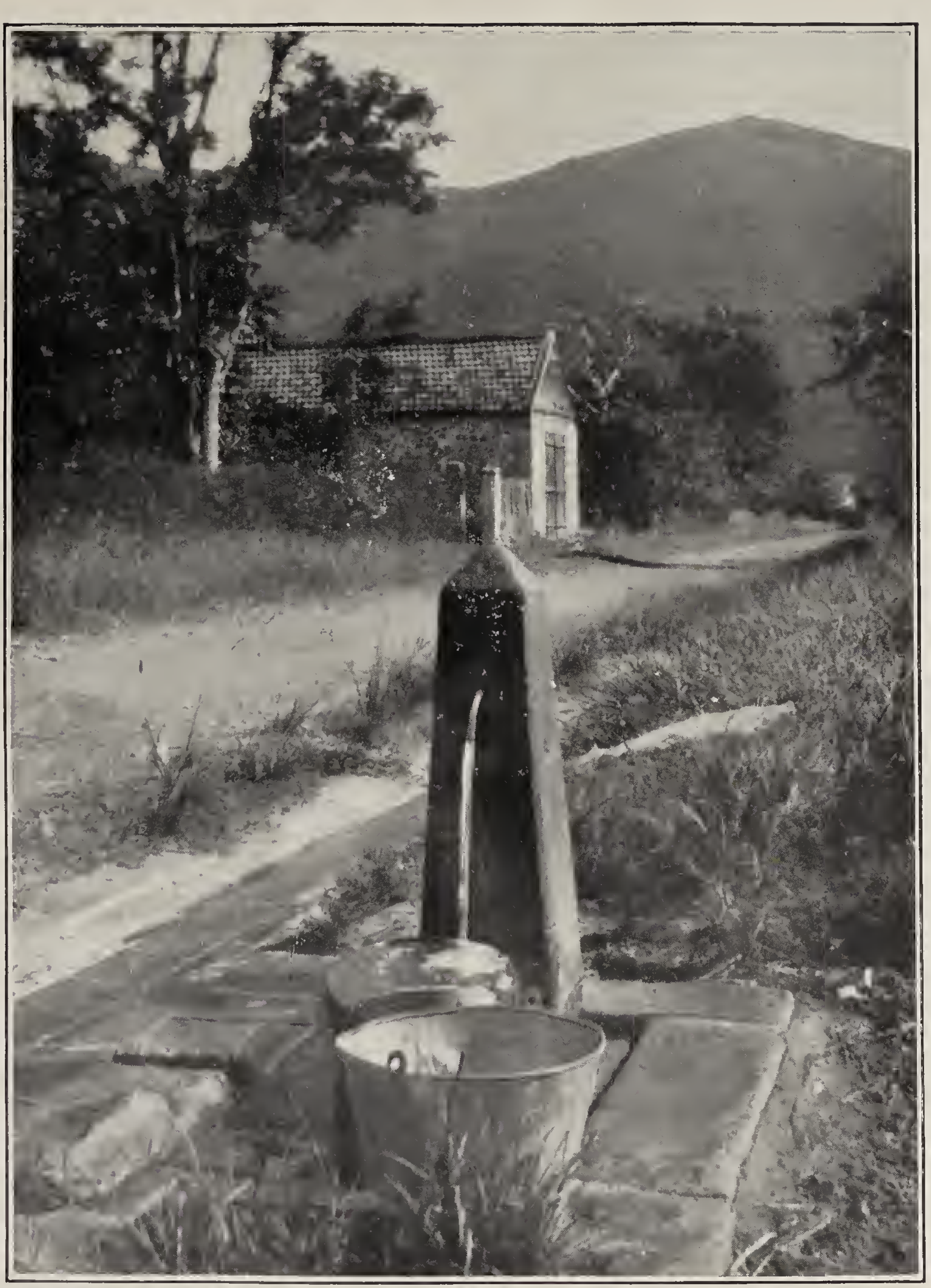
62.—A well-cover made from the end of a sugar factory boiler. Ample opportunities for pollution during the drawing of water.



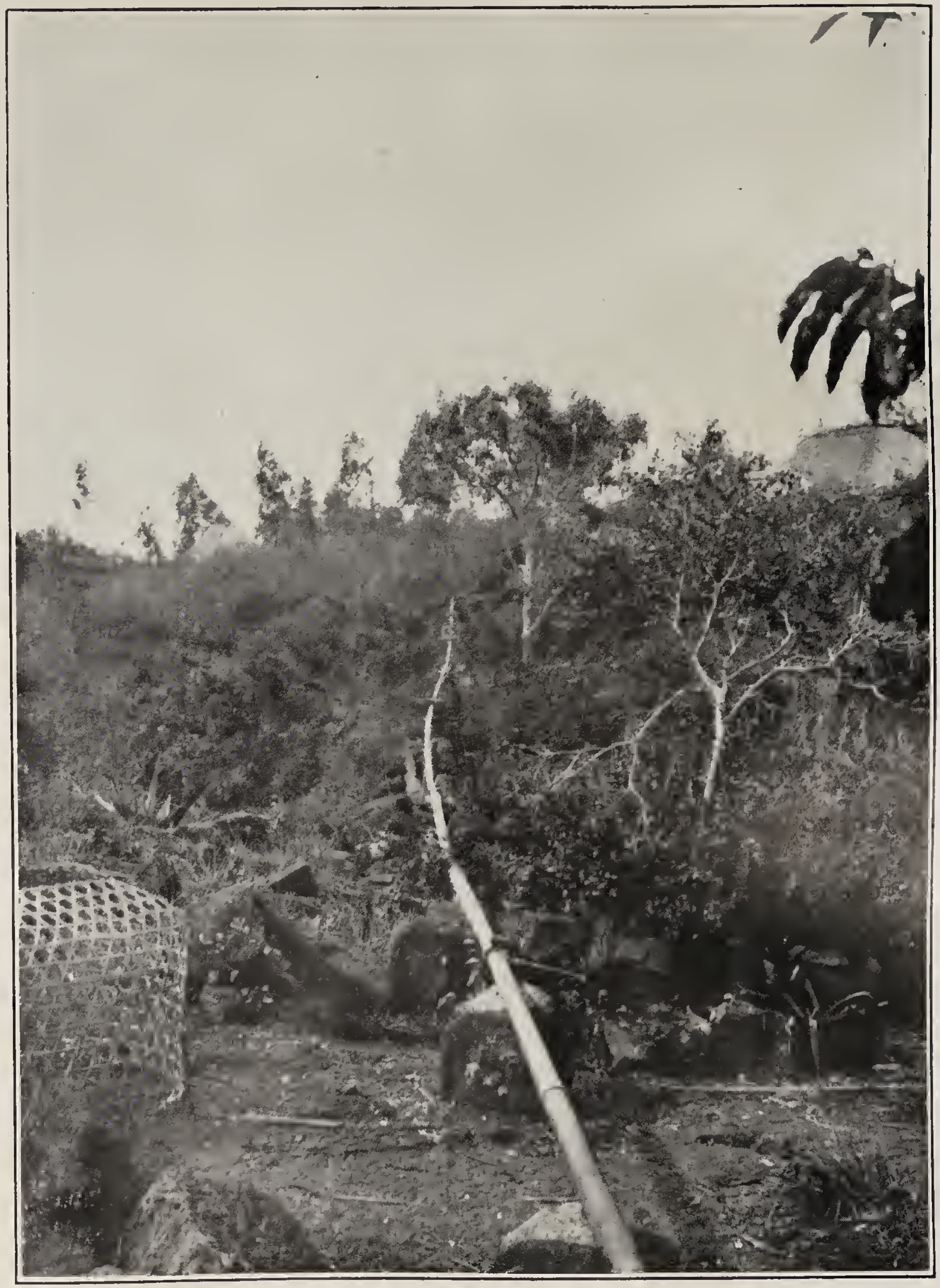
63.– Underground rain-water tank, Quarantine Station, Canonnier's Point. The water is derived from roof-washings and as the first washings are not rejected, is somewhat impure. Moreover, the pump had broken down and consequently resort has been had to dipping, which tended towards pollution of the supply.



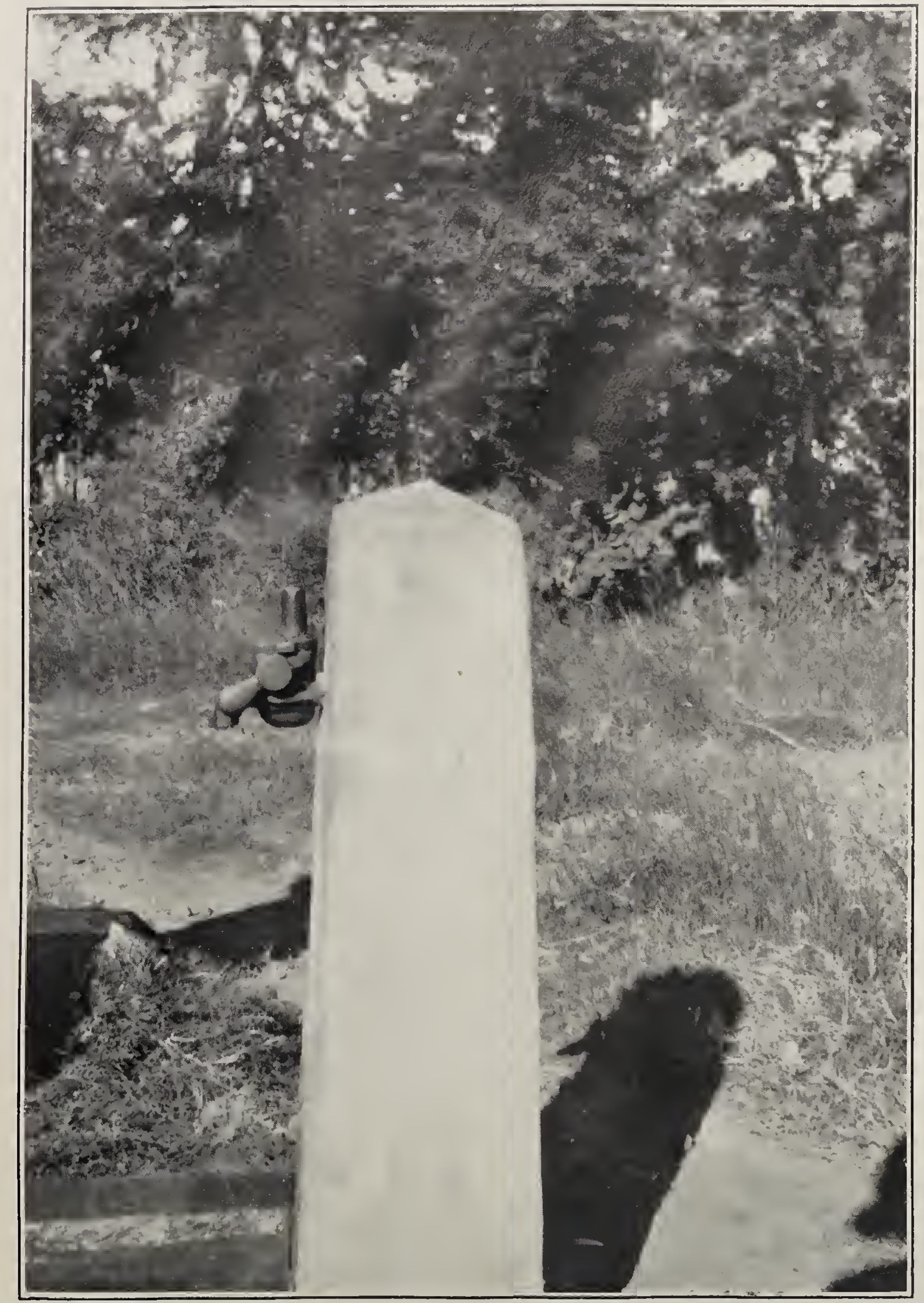
64.—Shallow well, Curepipe, showing facilities for fouling.



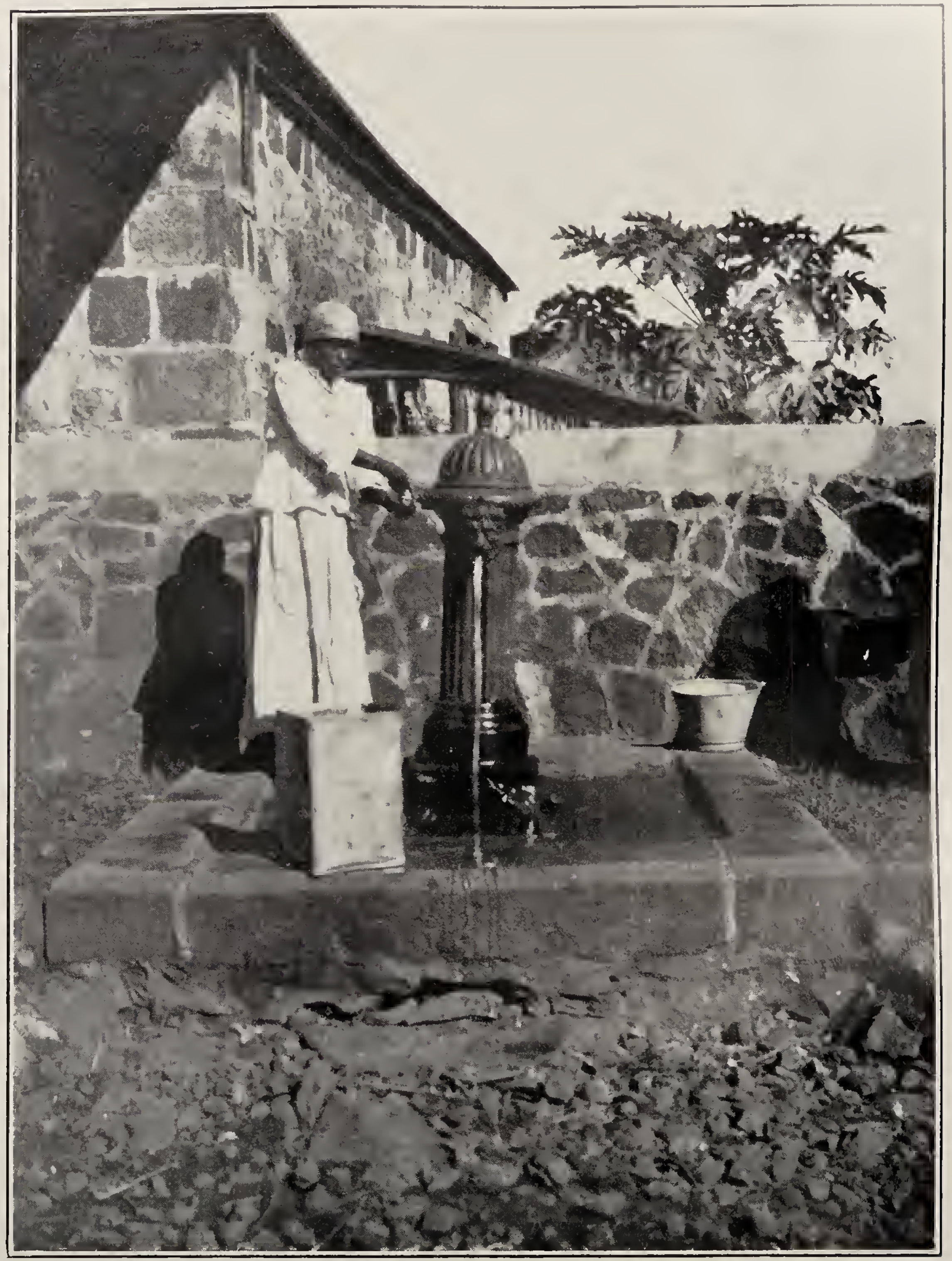
65.—One of the ever-running taps leading not only to a great waste of water, but to the formation of mosquito breeding places. Outskirts of Port Louis.



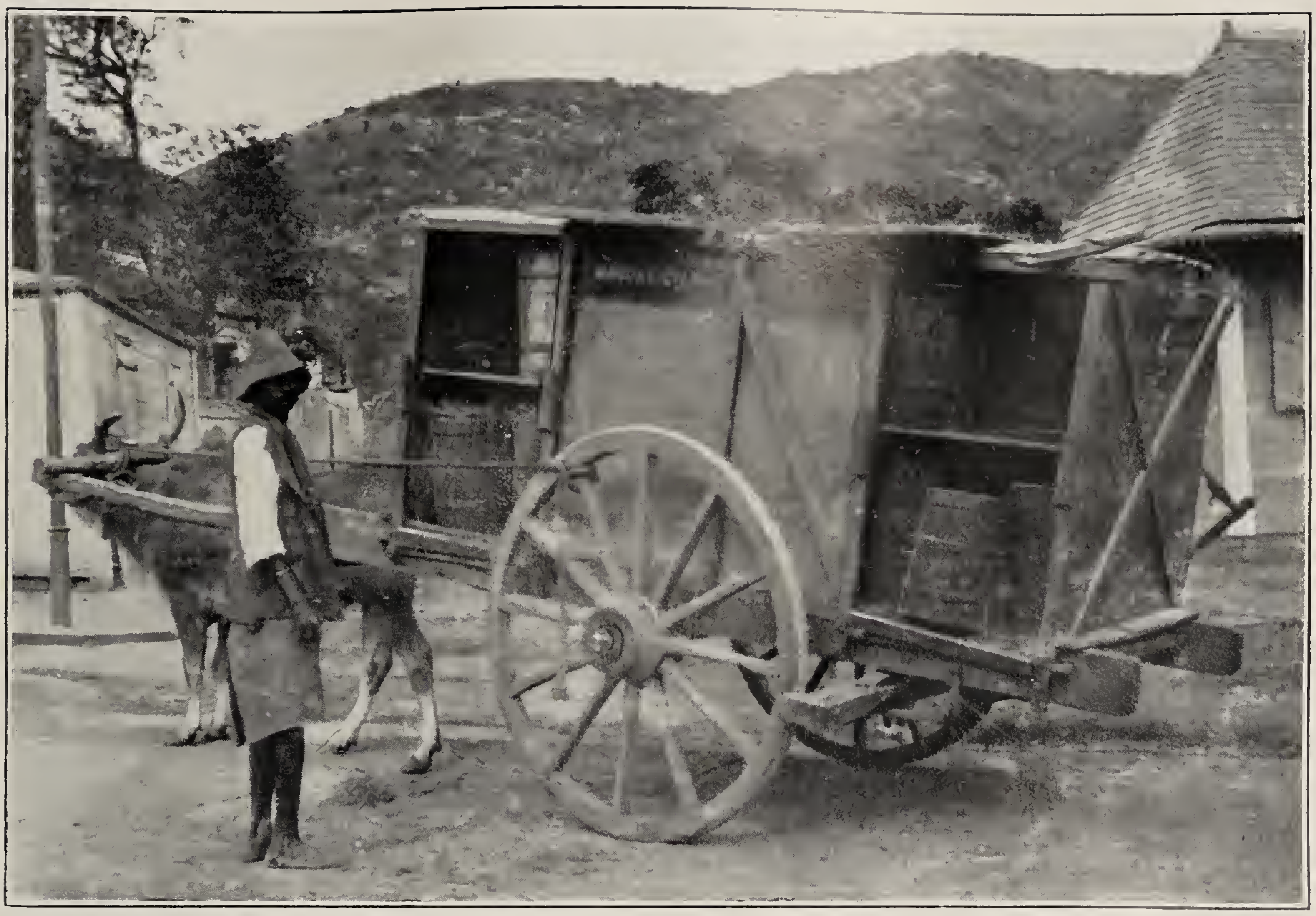
66.—Water pipe line laid above ground and exposed to sun's rays. Roche Noir, Flacq.



67.—Good type of self-closing tap for stand pipes. Cassis, Port Louis.

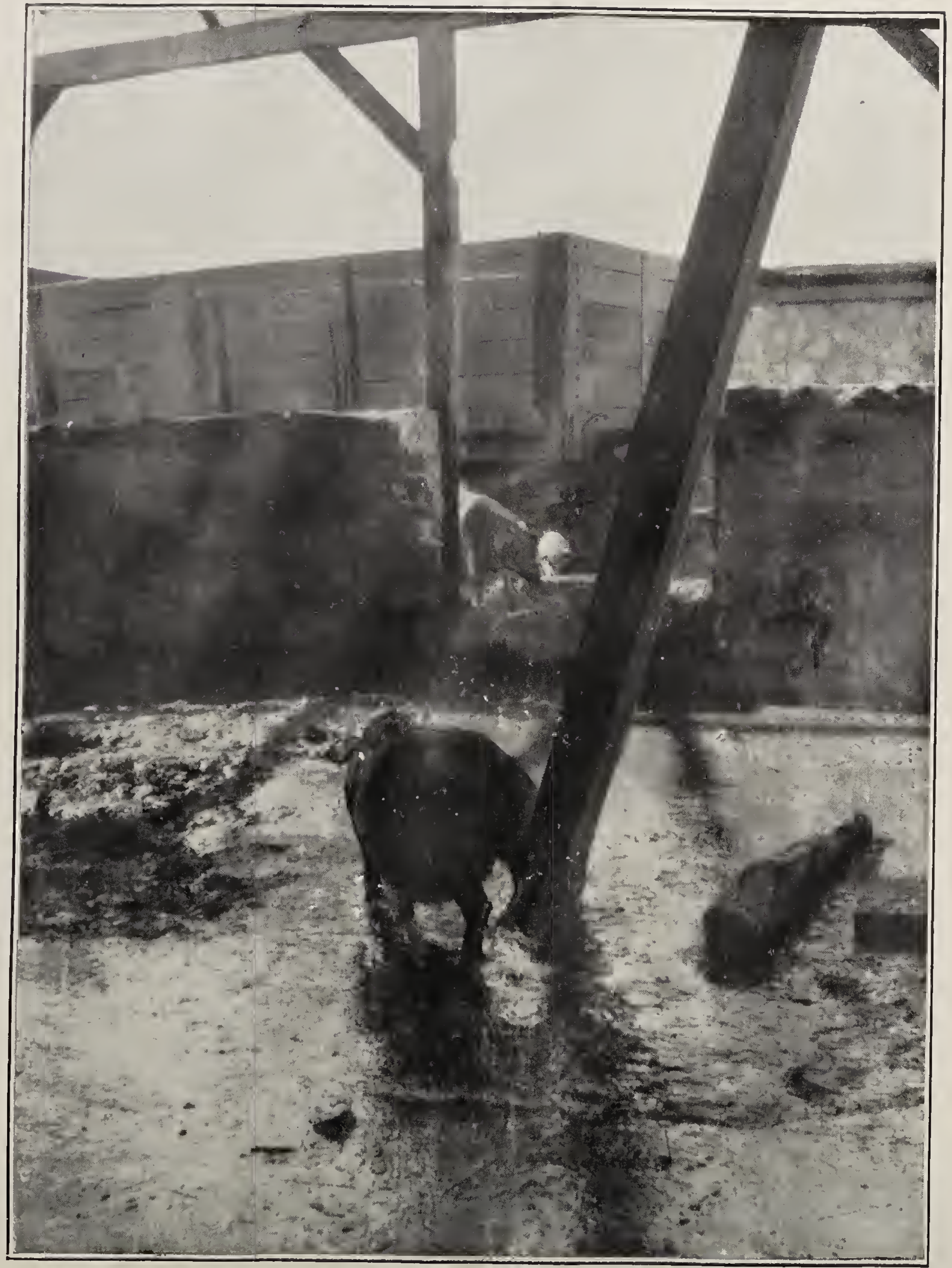


68.—Type of water fountain. These usually get damaged owing to theft of the copper parts.

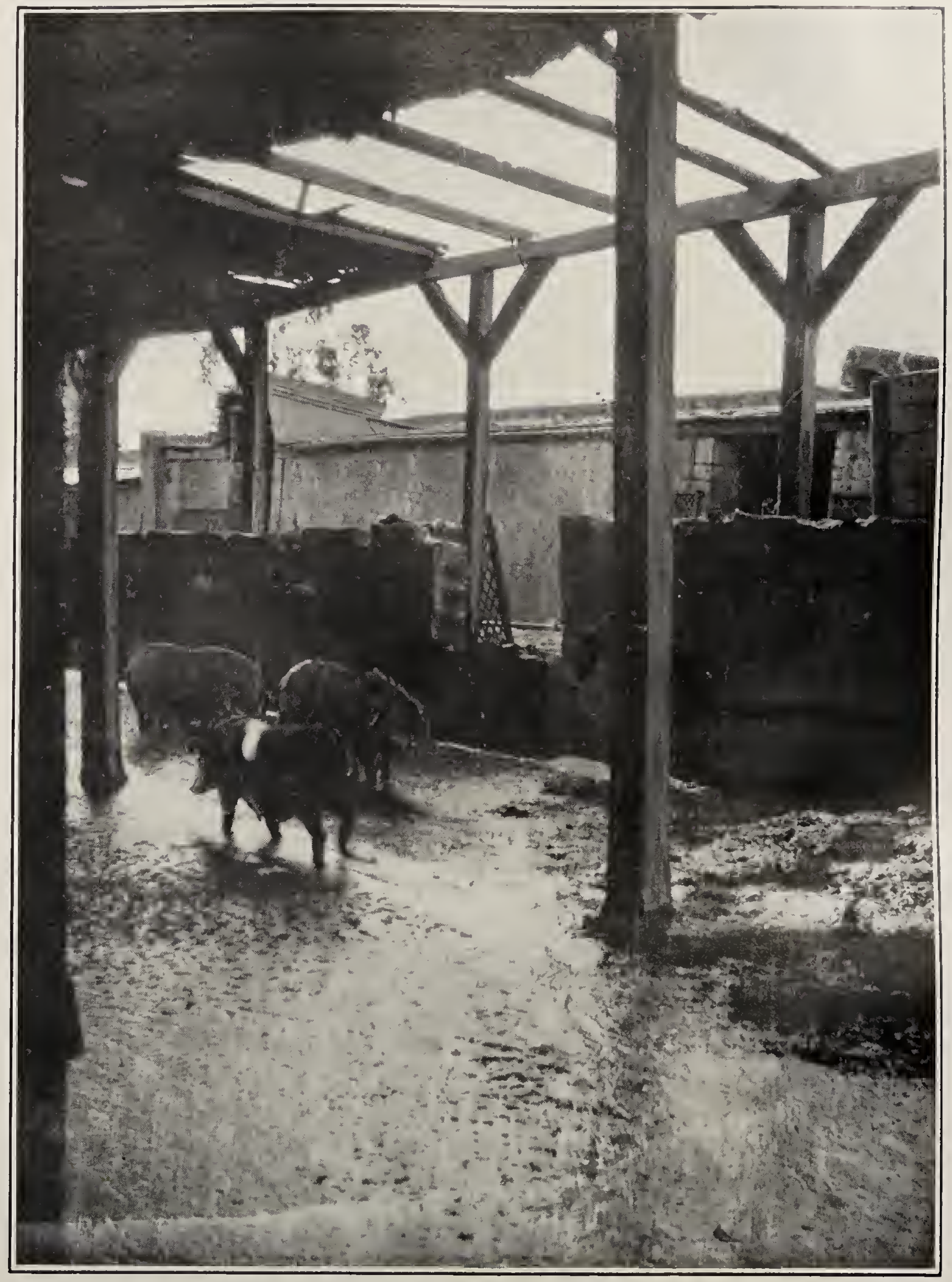


69.—A typical night-soil cart, Port Louis. It is furnished with sliding doors, which render the interior dark. The tubs are of wood and become very foul.

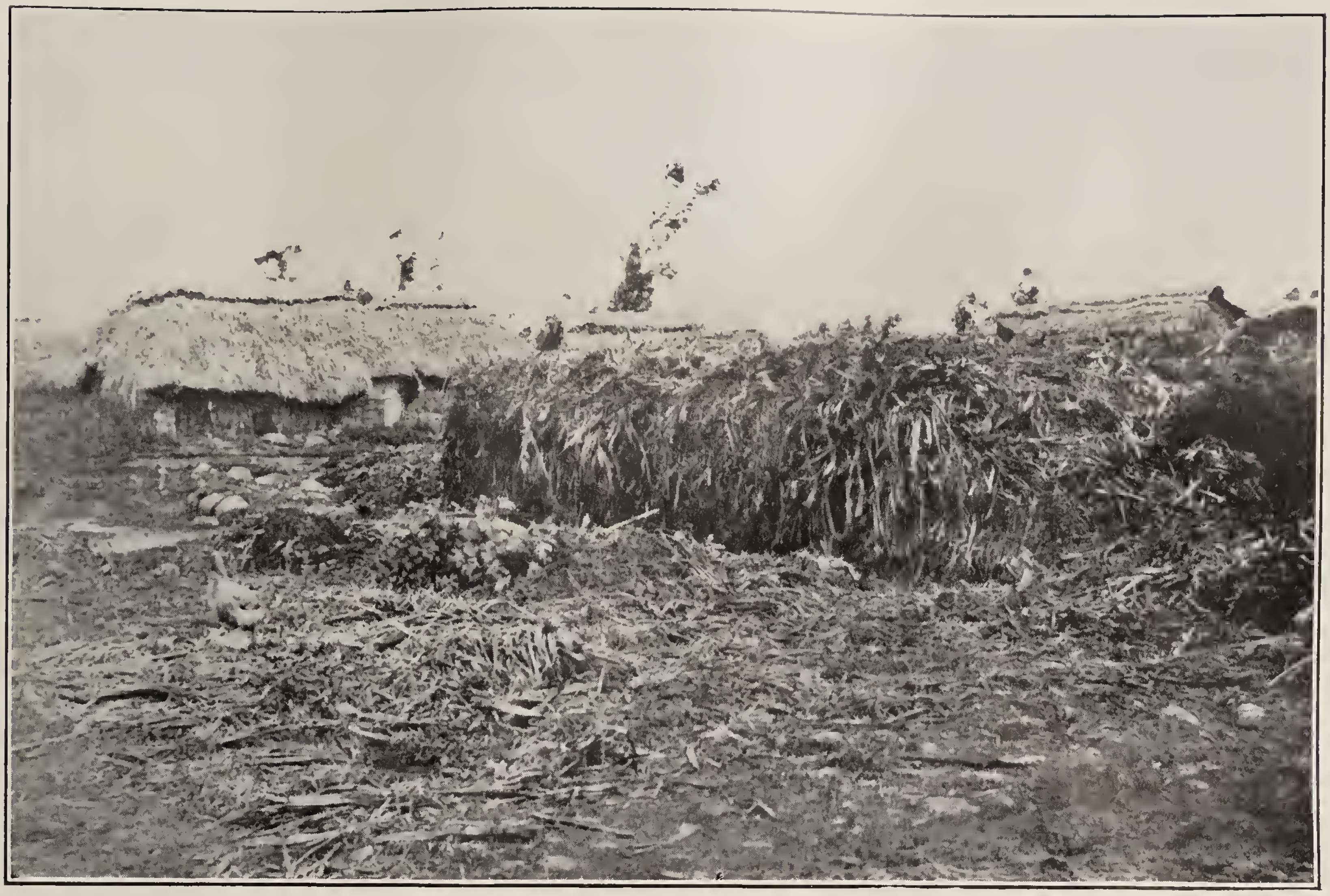
70.—An open type of engrais or manure pit. The sweeper is shown emptying the contents of a latrine bucket into the cement concrete tank. The human excrement is mixed with cane trash and rubbish of various kinds and the mass is eventually used for manuring the cane fields.



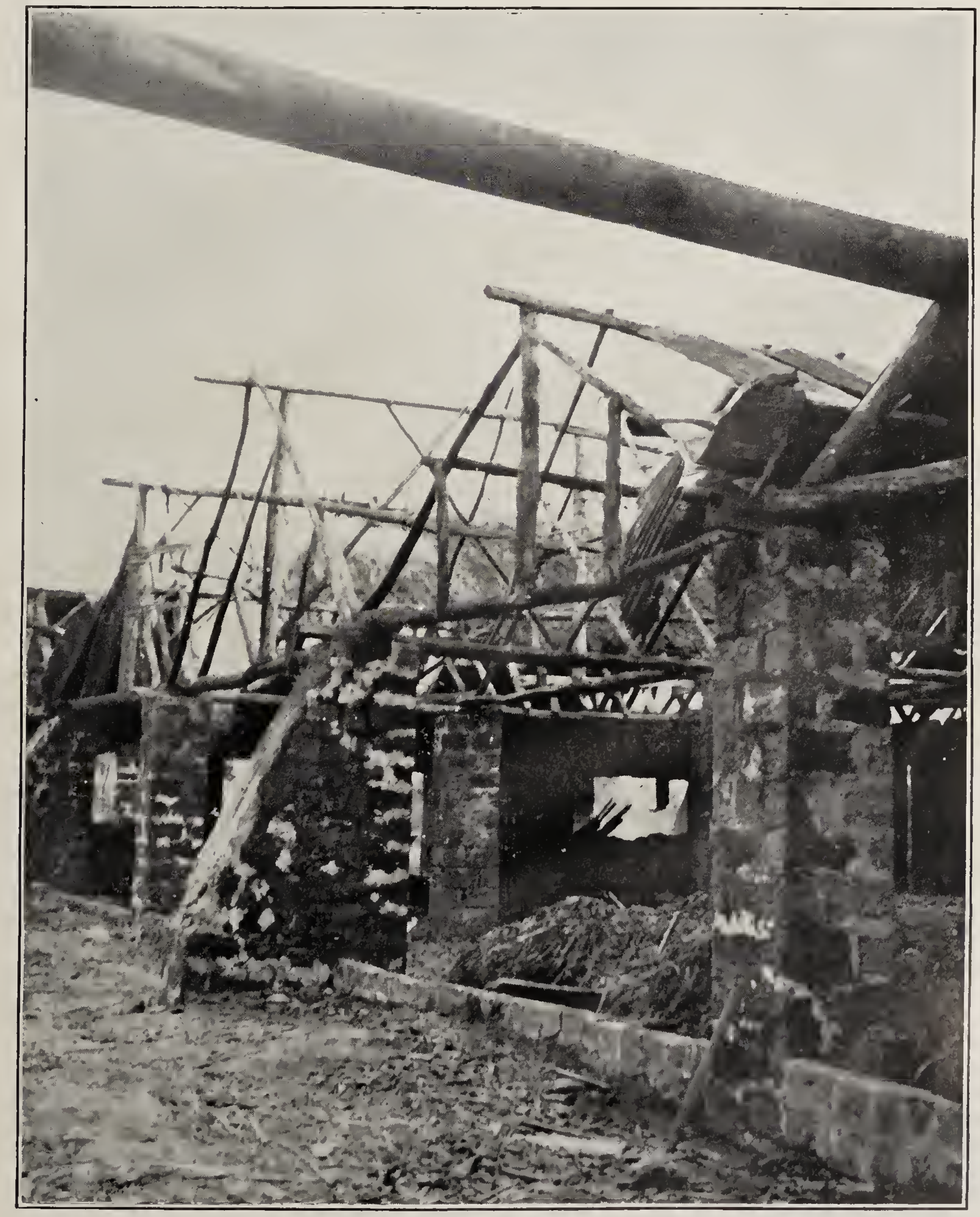
71.—Interior of one of the pits at the Roche Bois Manure Factory, Port Louis. The containing wall is broken and pigs have access to the human excrement. They are here shown wading in the latter.



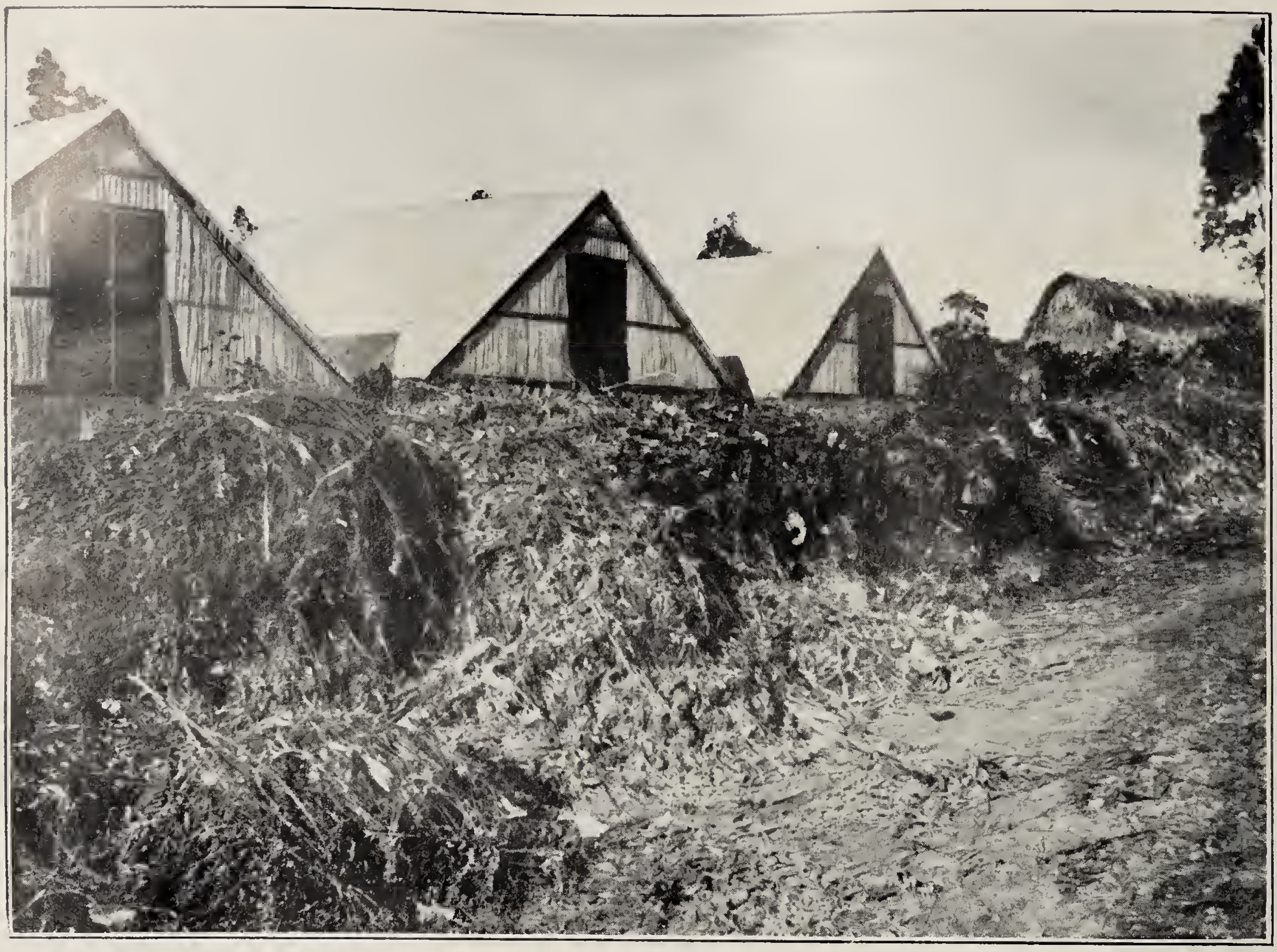
72.—Another view of sewage pit at Roche Bois Manure Factory. Note ruinous condition of roof.



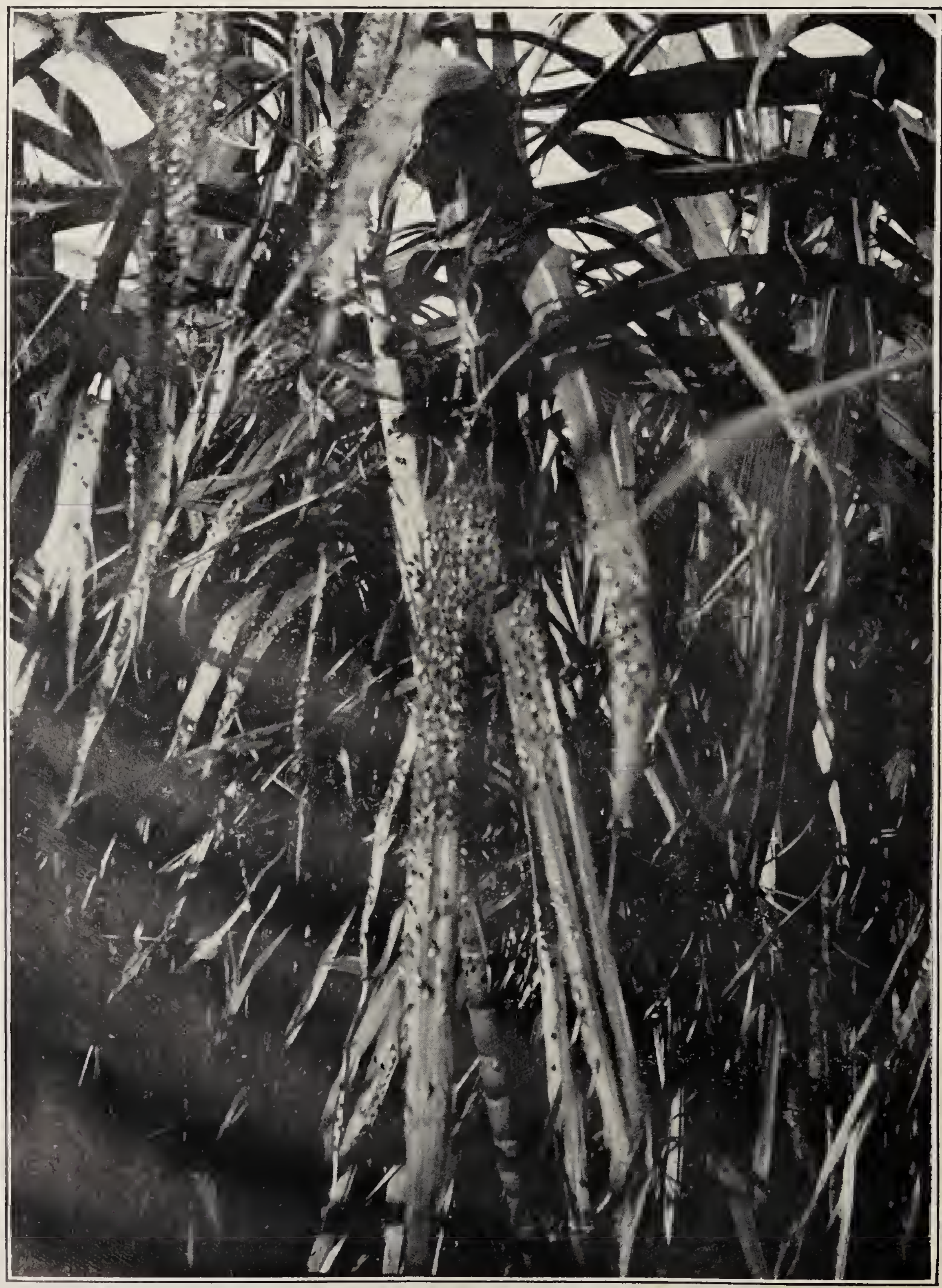
73.—Manure heap in which pail contents are buried and drainage of which finds its way into a water course.
Alma Sugar Estate, Moka.



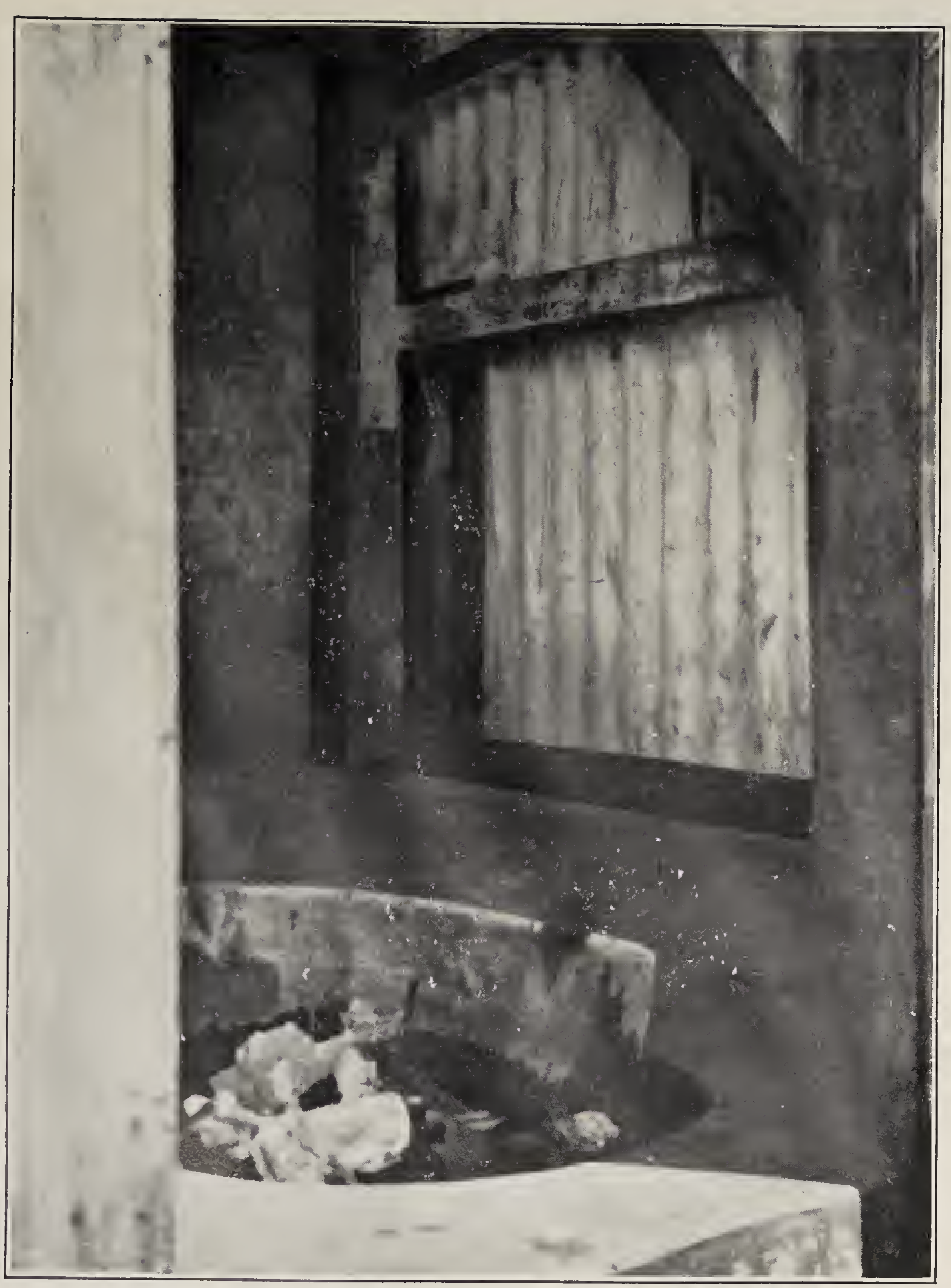
74.—The Engrais in use at Constance La Gaite Estate, Flacq. Note ruinous condition.



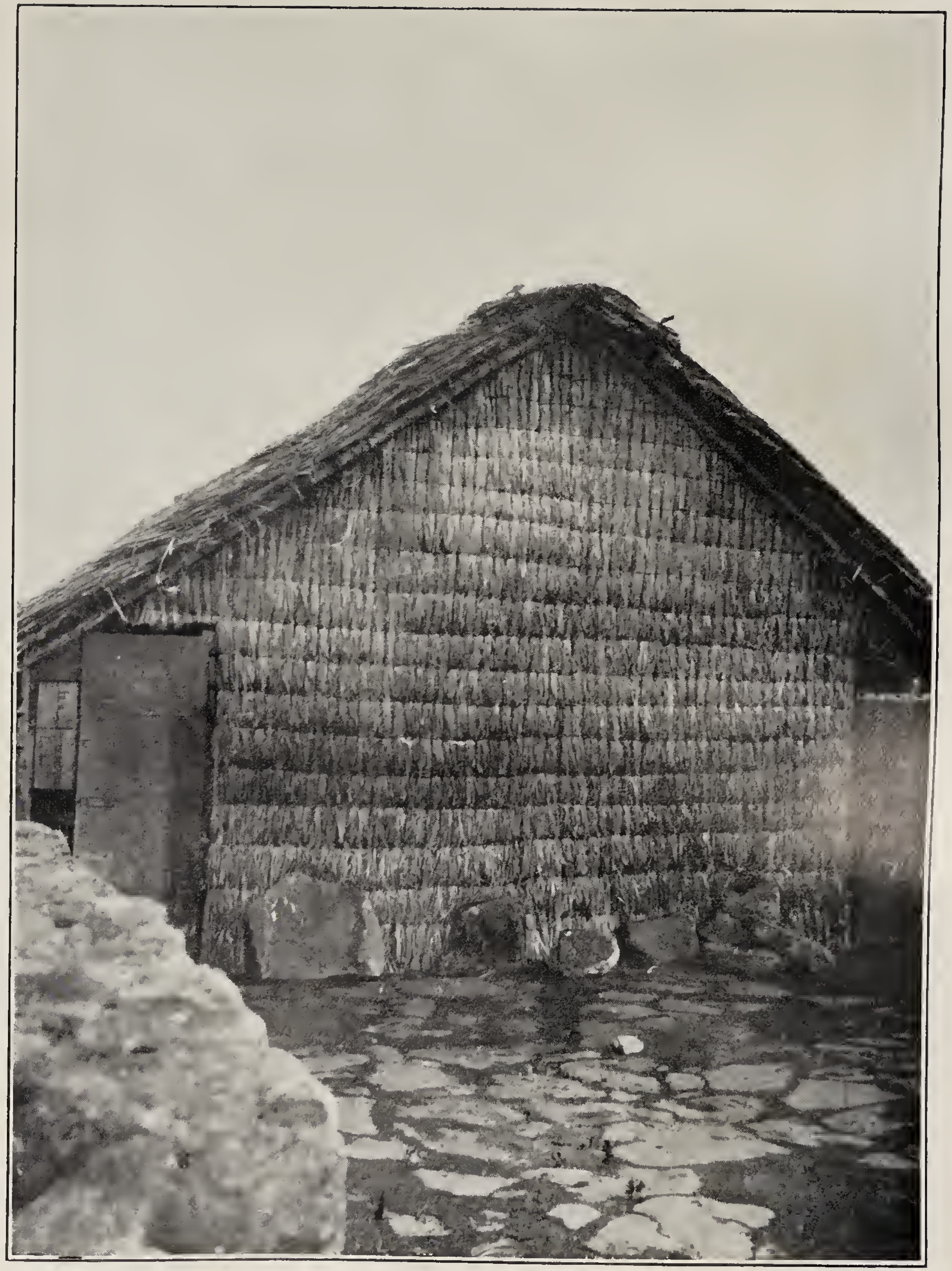
75.—Engrais buildings at Curepipe, showing mass of town refuse in foreground.



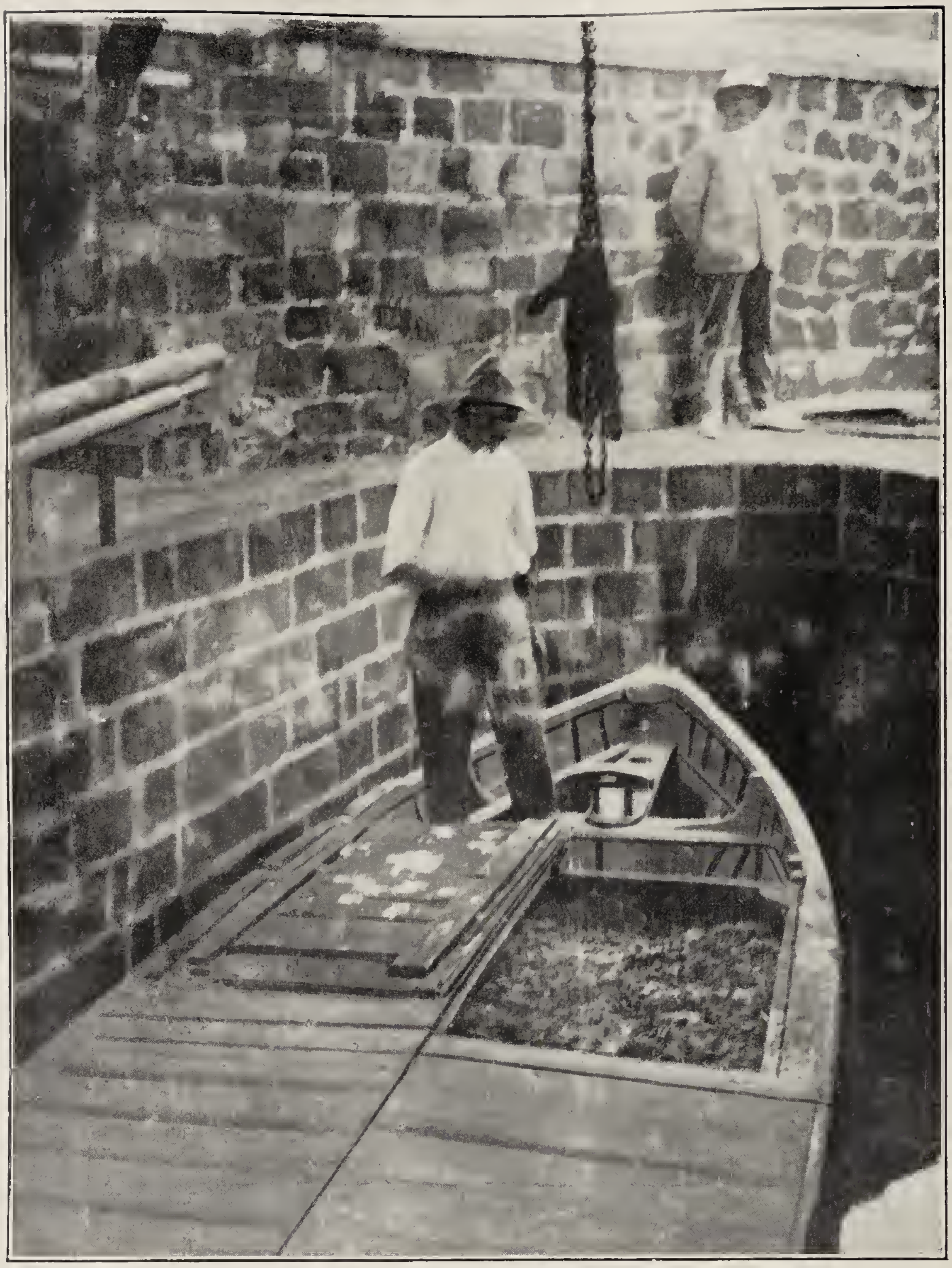
76.—Cane leaves covered with flies bred out in above engrais.



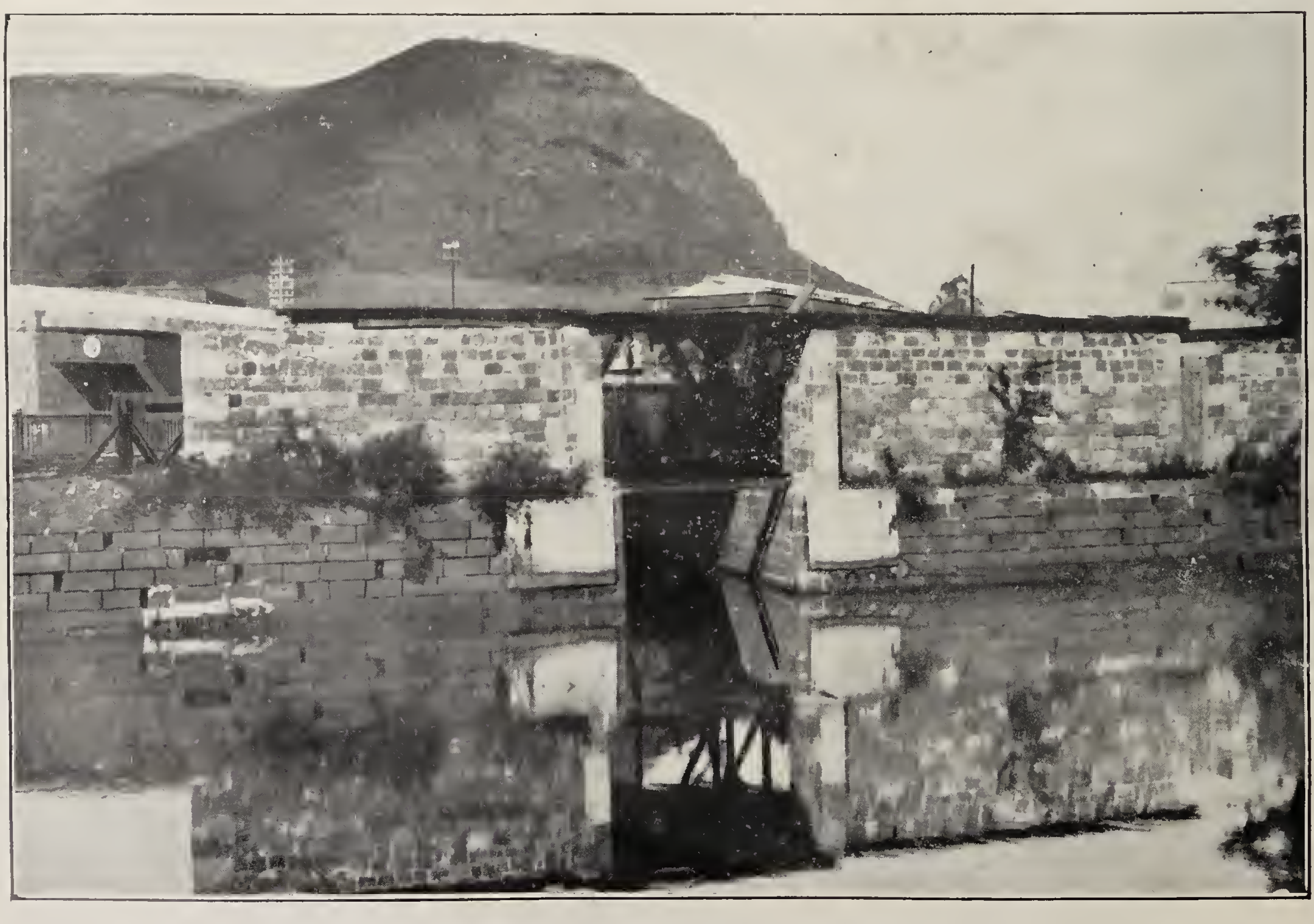
77.—Interior of water closet, Central Market, Port Louis. This filthy place was only a few yards from the meat stalls.



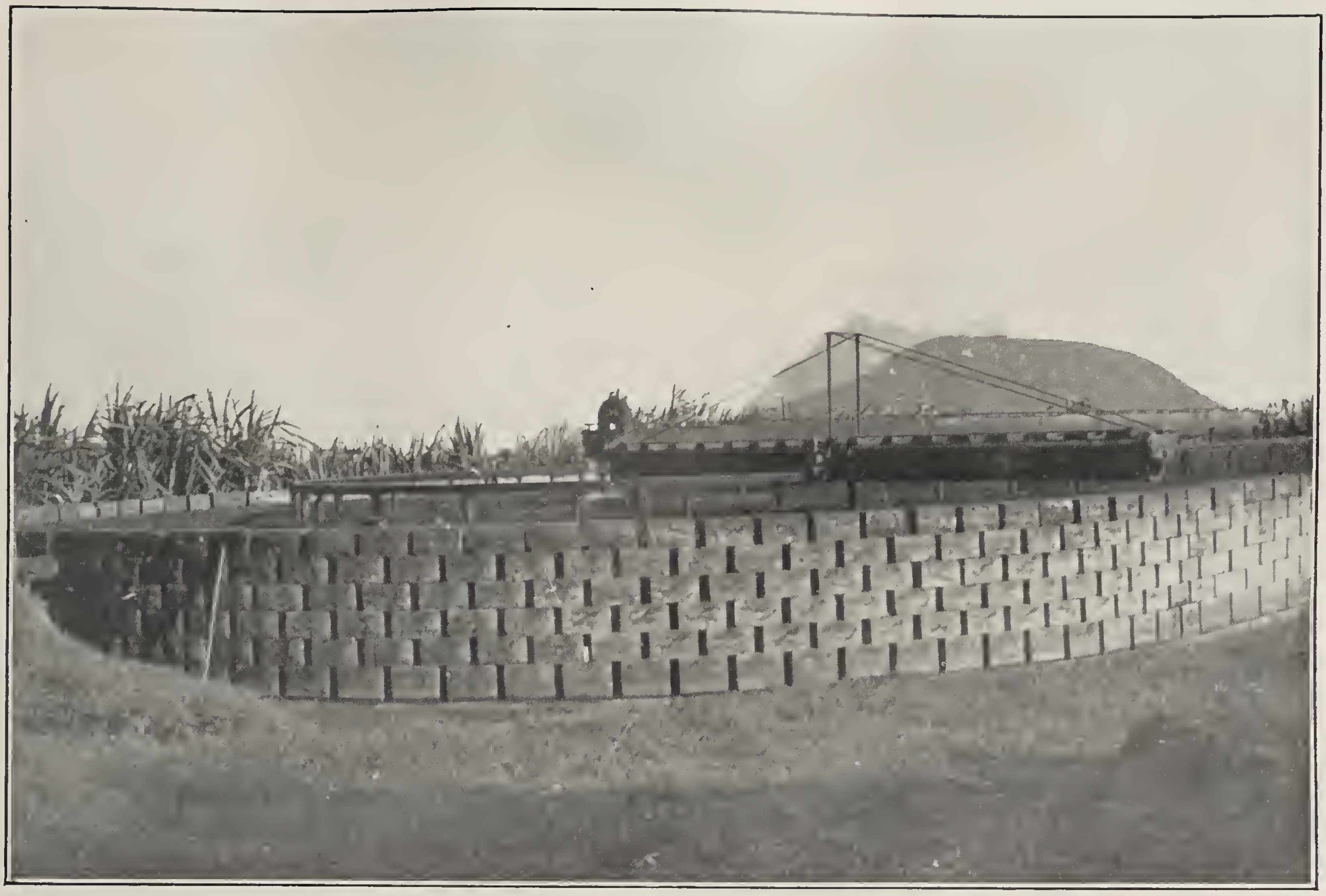
78.—Carefully constructed closed Engrais at Mon Loisir (Adam) Estate, Rivière du Rempart.



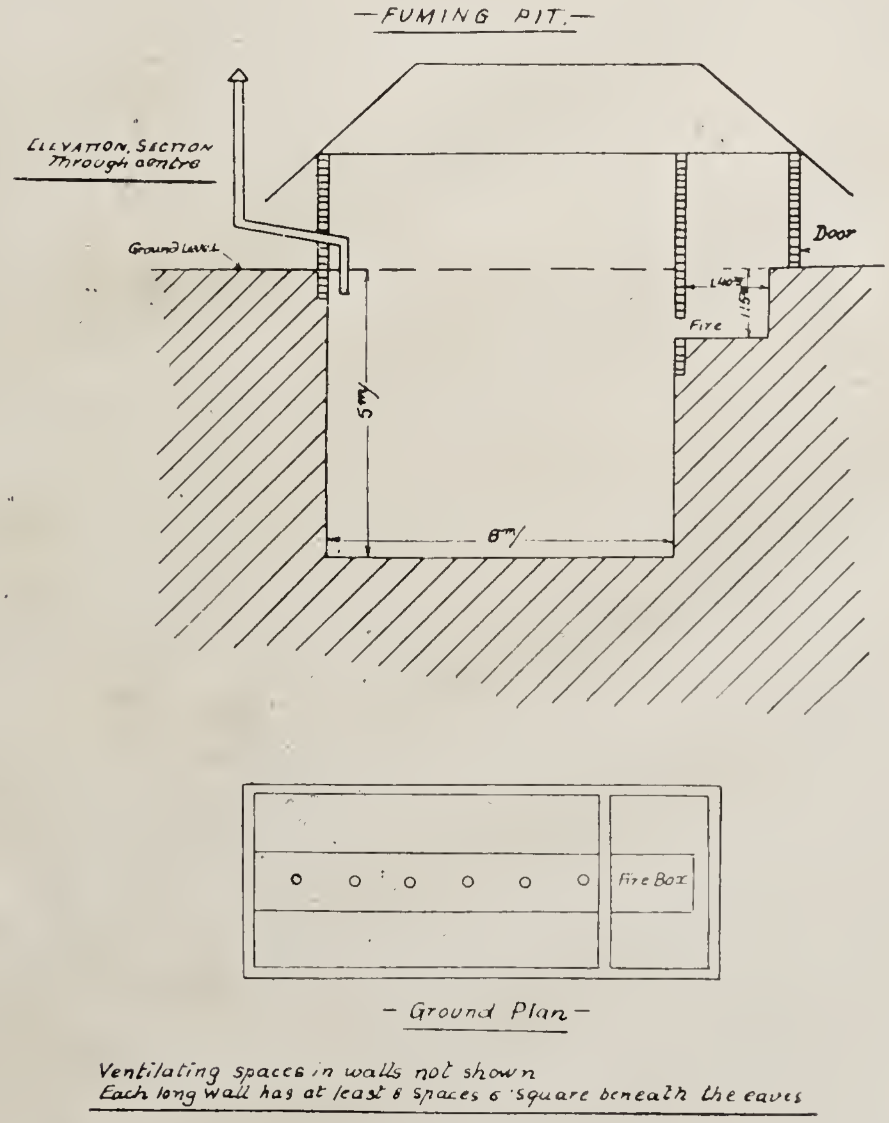
79.—Boat employed for removing a portion of the contents of the sewers which, owing to partial failure of the pumps and the small size of the outfall, are insufficient to deal with the total daily flow. The boat discharges its contents in or outside the harbour and is a happy hunting ground for flies.



80.—Canal leading to Candan Basin. Note, on the left, grating through which sewage is discharged into the canal. The opening in the centre is for the entry of the sewage boat shown in the picture above.

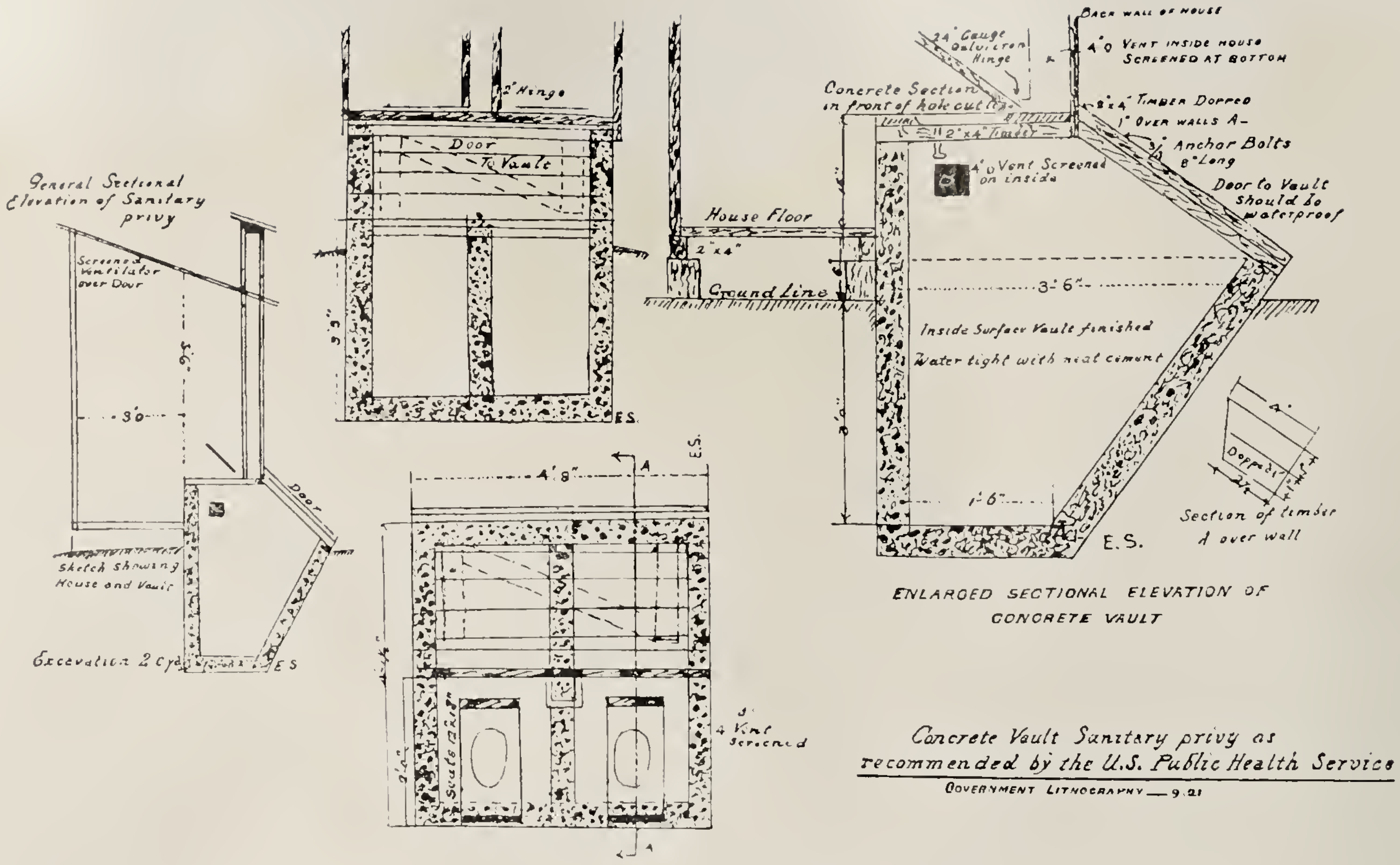


81.—Percolating filter, Vacoas Camp.



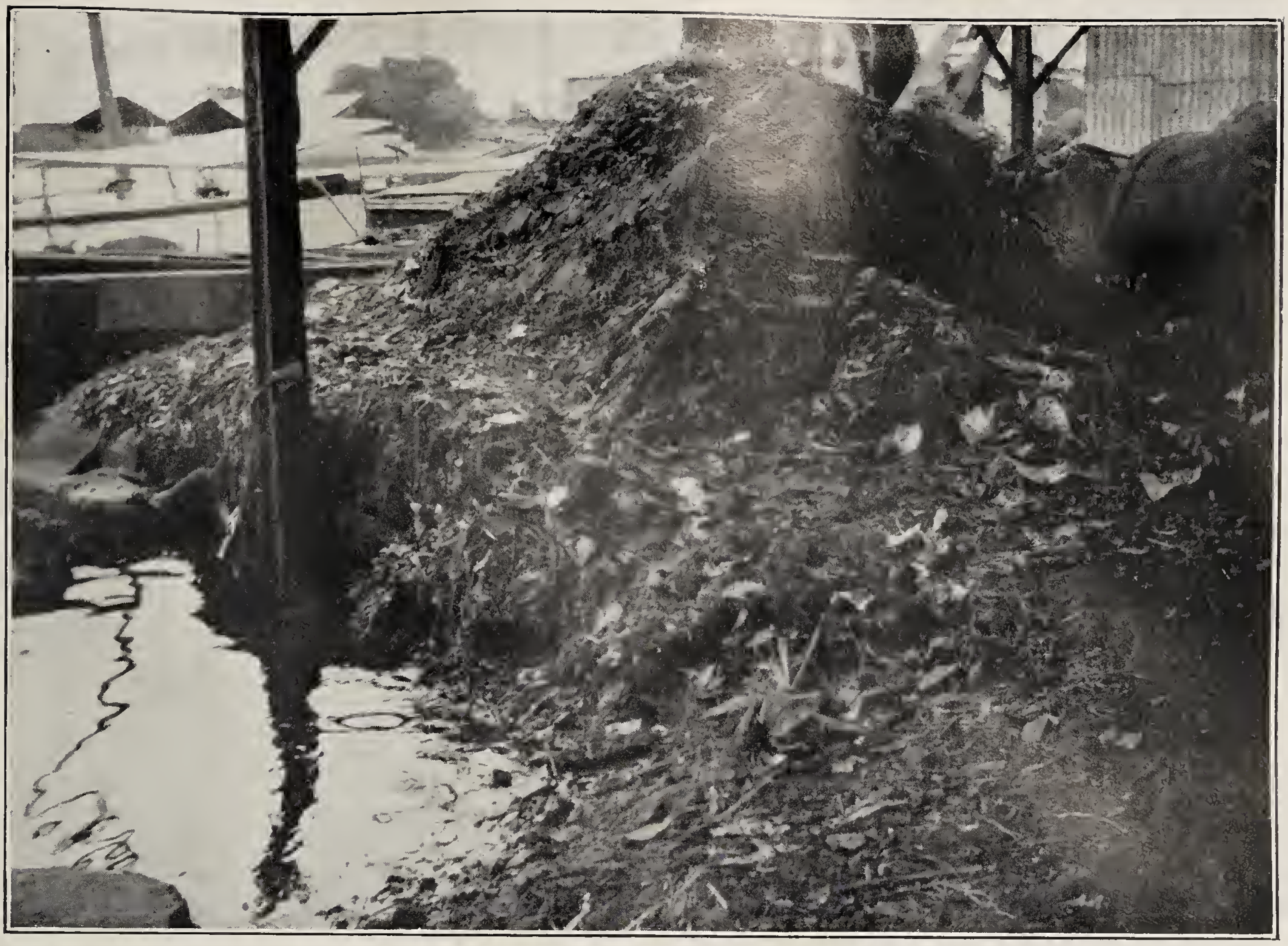
After Pearson.

82.—Plan of Fuming Pit Latrine.

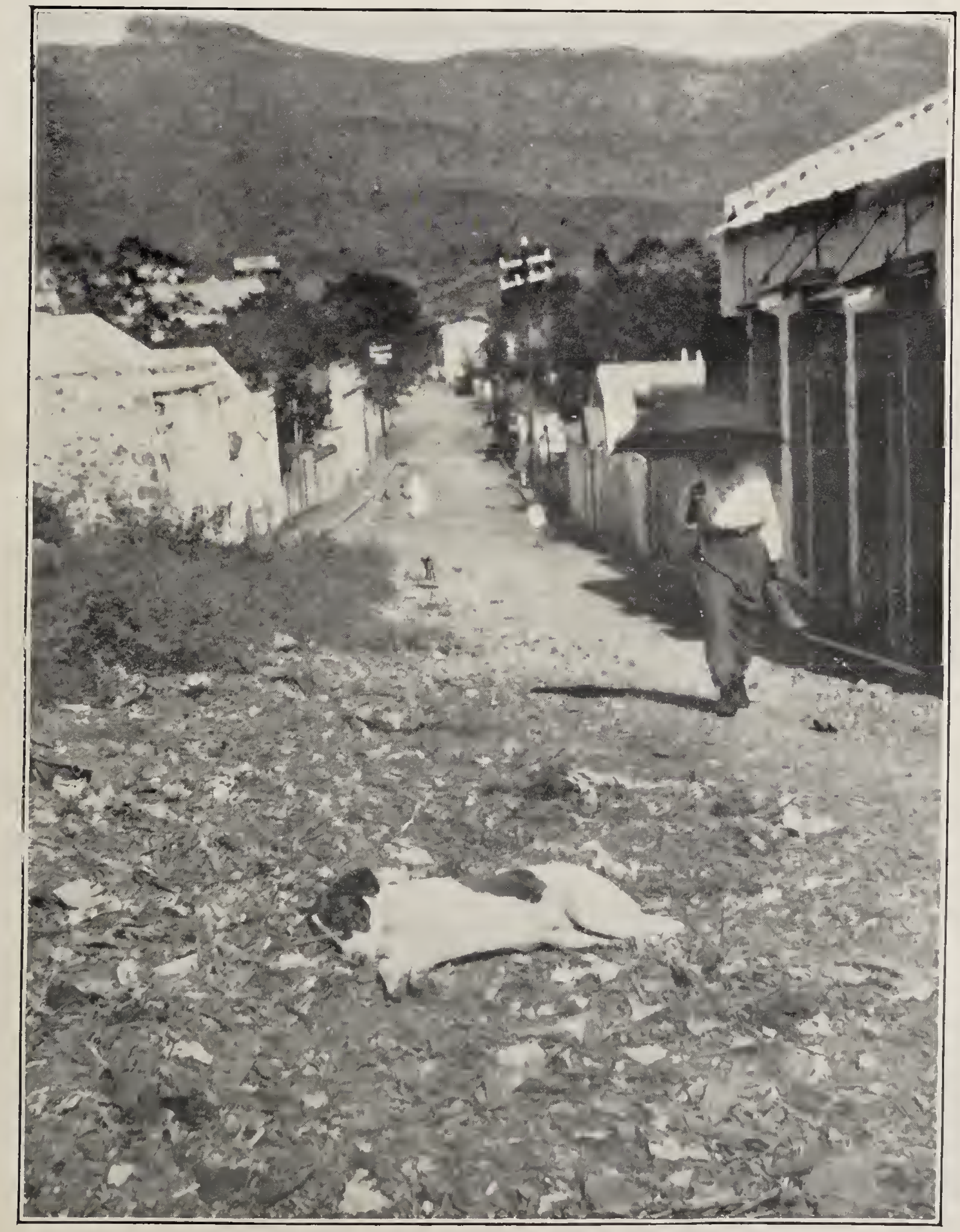

General Sectional Elevation of Sanitary privy
Screened Ventilator over Door
5'6"
3'0"
Door
Sketch Showing House and Vault
Excavation 2 Cyds
E S
2" Hinge
Door To Vault
3'3"
E.S.
House Floor
2"x4"
Ground Line
4'8"
A
E.S.
Seats 12x18"
2'6"
4" Vent Screened
A
24" Gauge Galvinized Hinge
Back wall of house
4"⌀ Vent inside house Screened at bottom
Concrete Section in front of hole cutting
2"x4" Timber Dopped 1" over walls A-
2"x4" Timber
3/4" Anchor Bolts 8" Long
4"⌀ Vent Screened on inside
Door to Vault should be waterproof
3'-6"
Inside Surface Vault finished Water tight with neat cement
3'6"
1'-6"
E.S.
Dopped 1"
Section of timber A over wall
ENLARGED SECTIONAL ELEVATION OF CONCRETE VAULT
Concrete Vault Sanitary privy as recommended by the U.S. Public Health Service
Government Lithography — 9.21

83.—Plan of Concrete Vault Sanitary Privy.

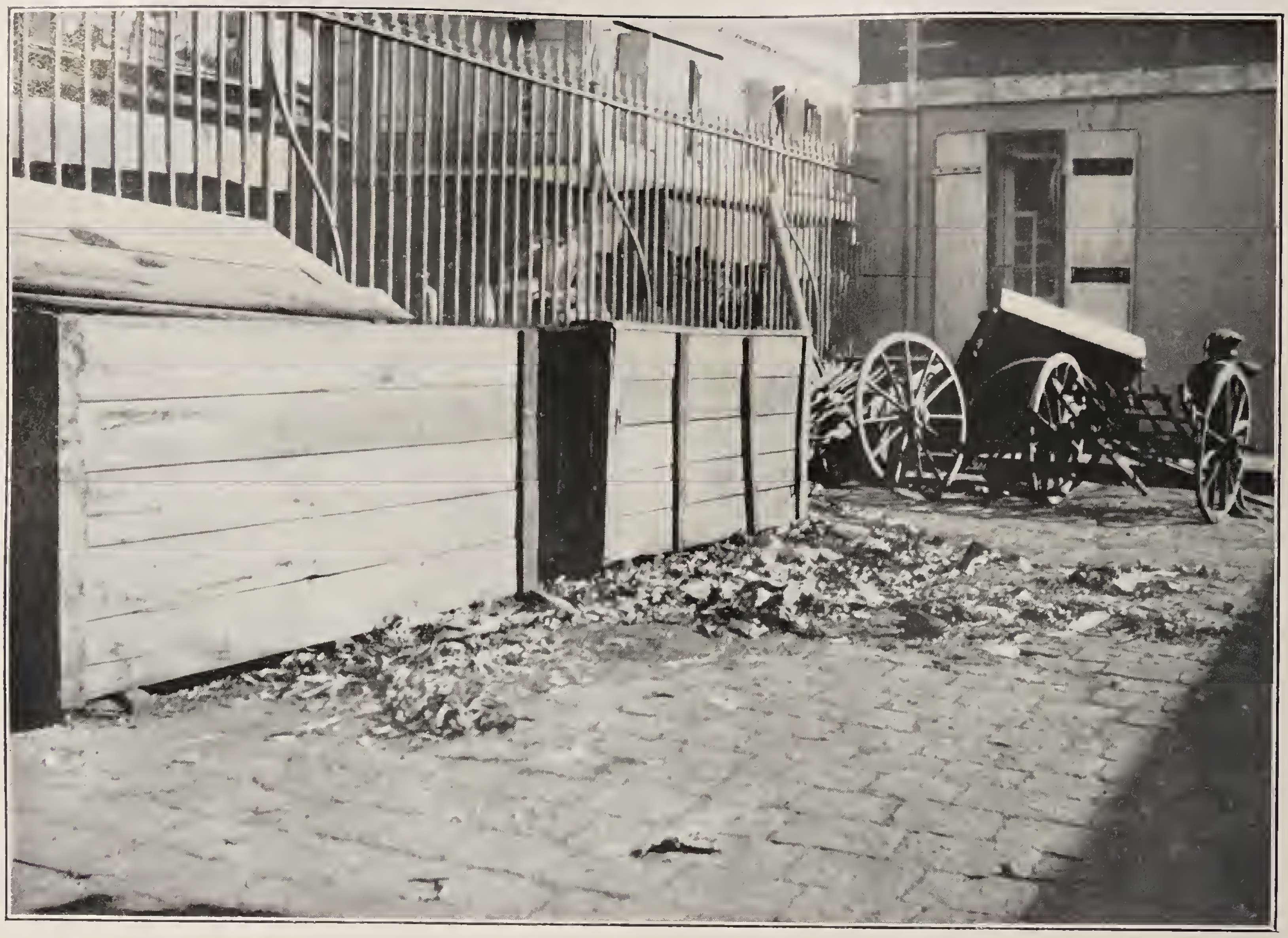
84.—Exterior of Fuming Pit Latrine building erected at St. Hubert Estate, Grand Port.



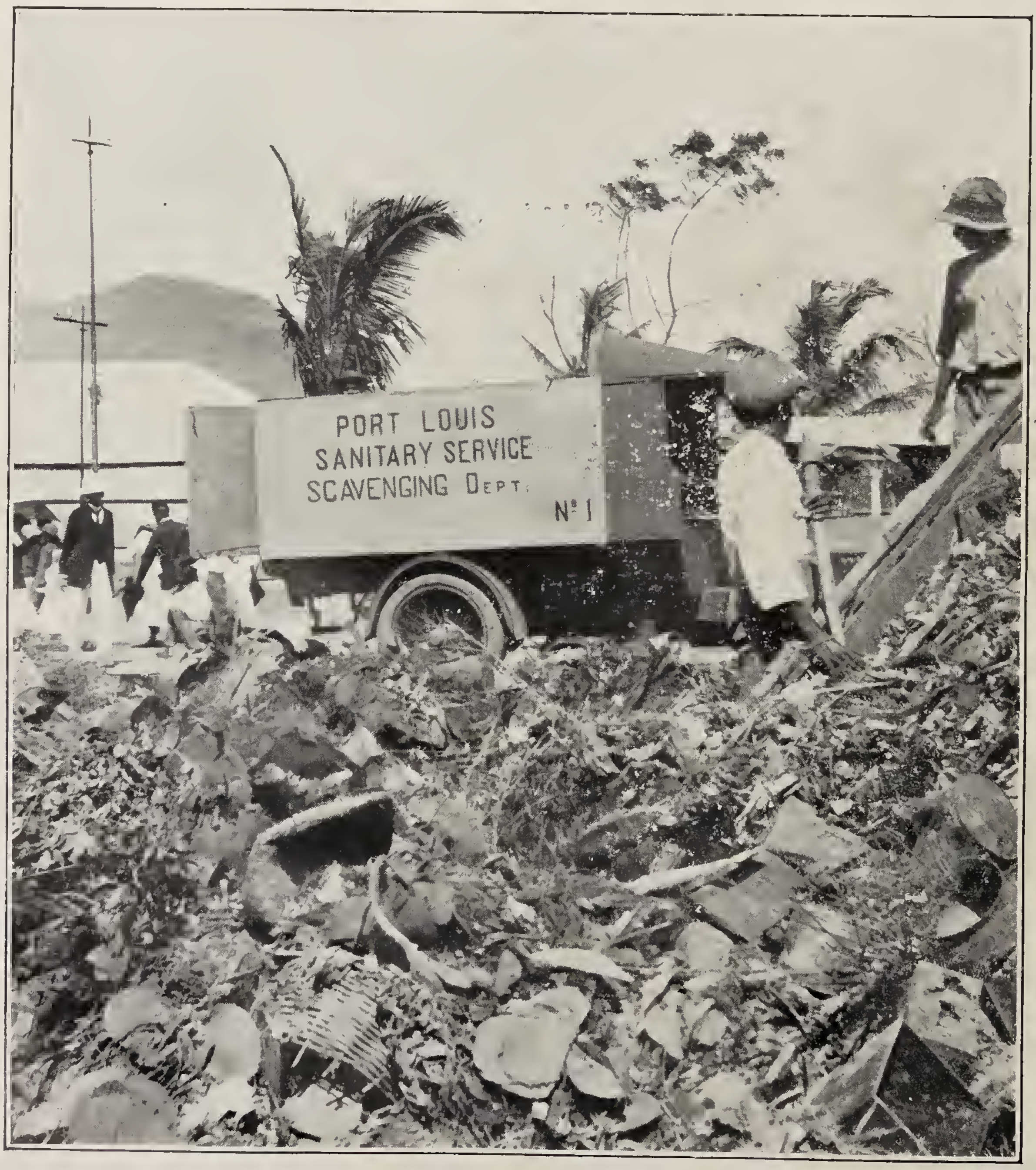
85.—A refuse heap and rat-playground on the harbour front, Port Louis.



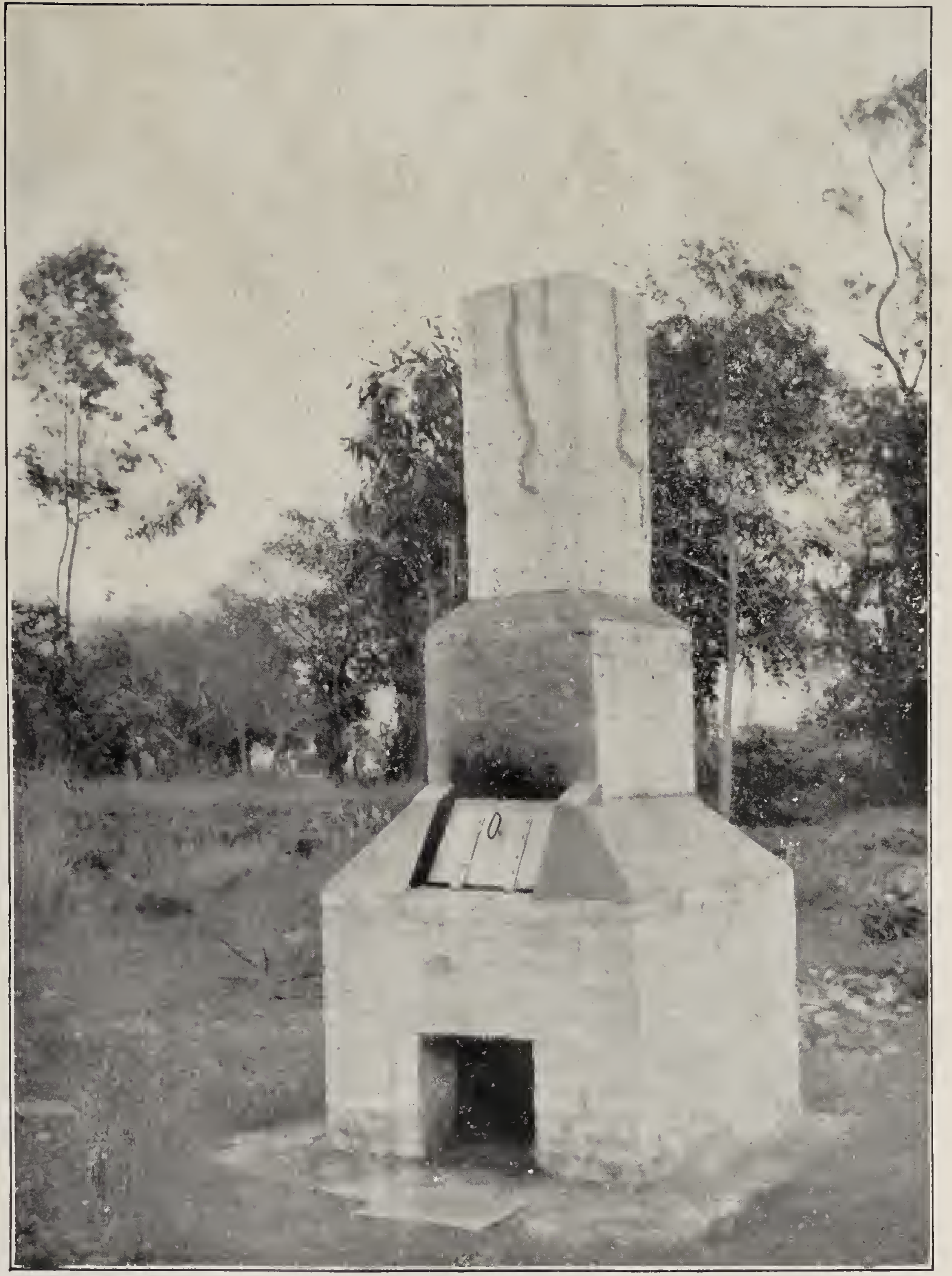
86.—Port Louis street showing collection of refuse.



87.—Refuse receptacles, Central Market, Port Louis. Note careless method of use.

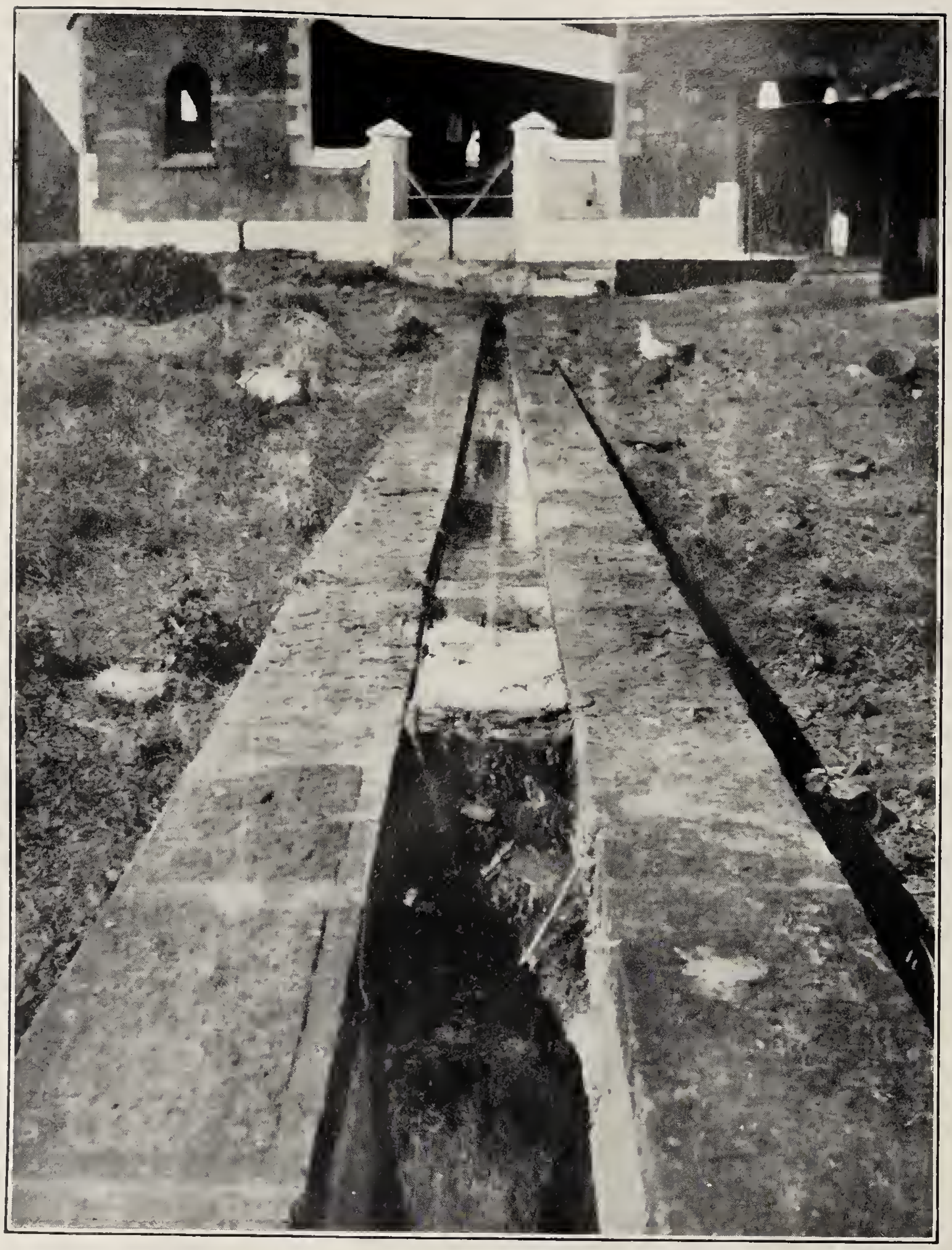


88.—New type of refuse lorry introduced by Dr. Gilchrist and collection of refuse awaiting removal in Port Louis.

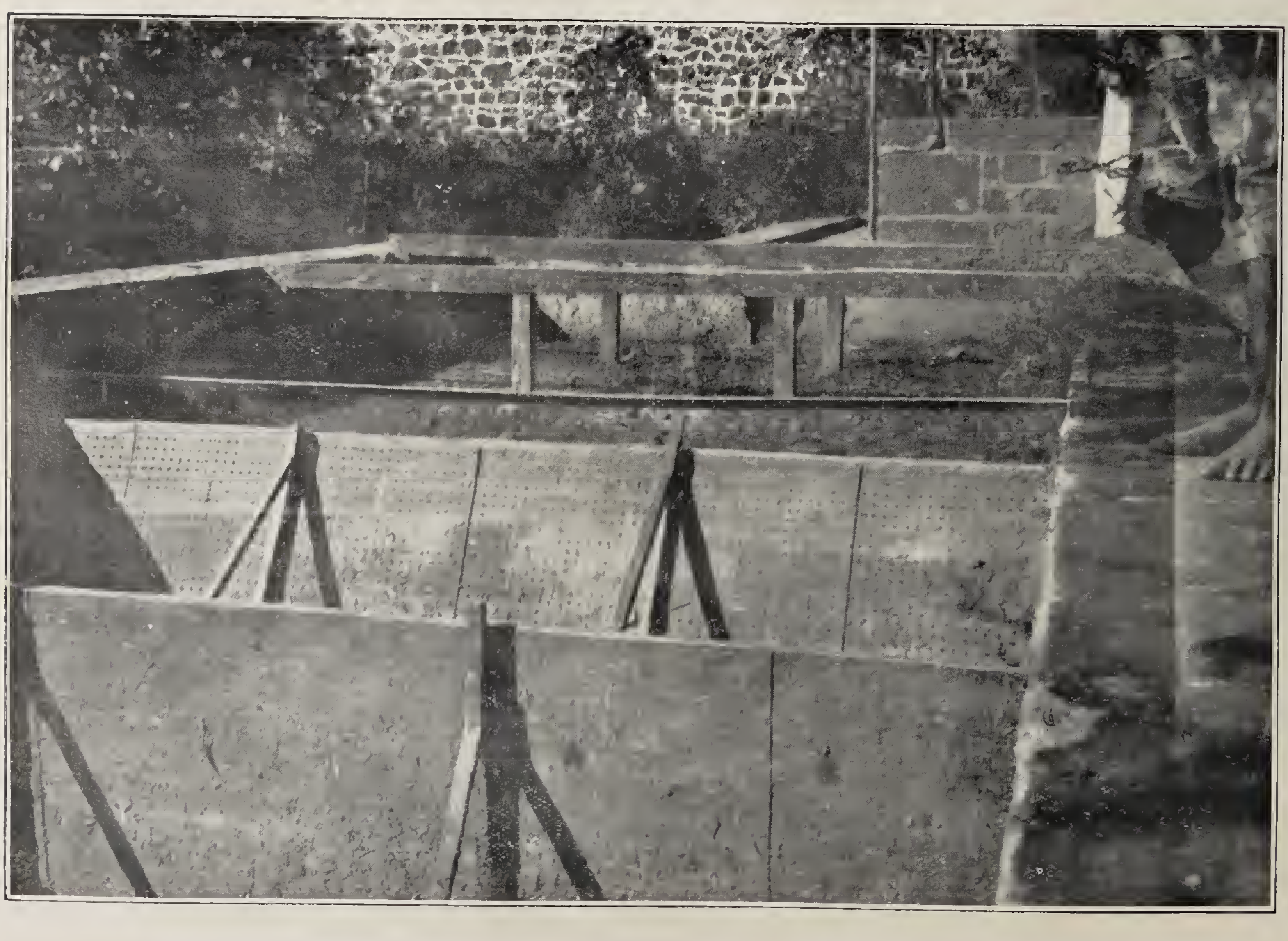


89.—Refuse incinerator erected at model village, Cassis.

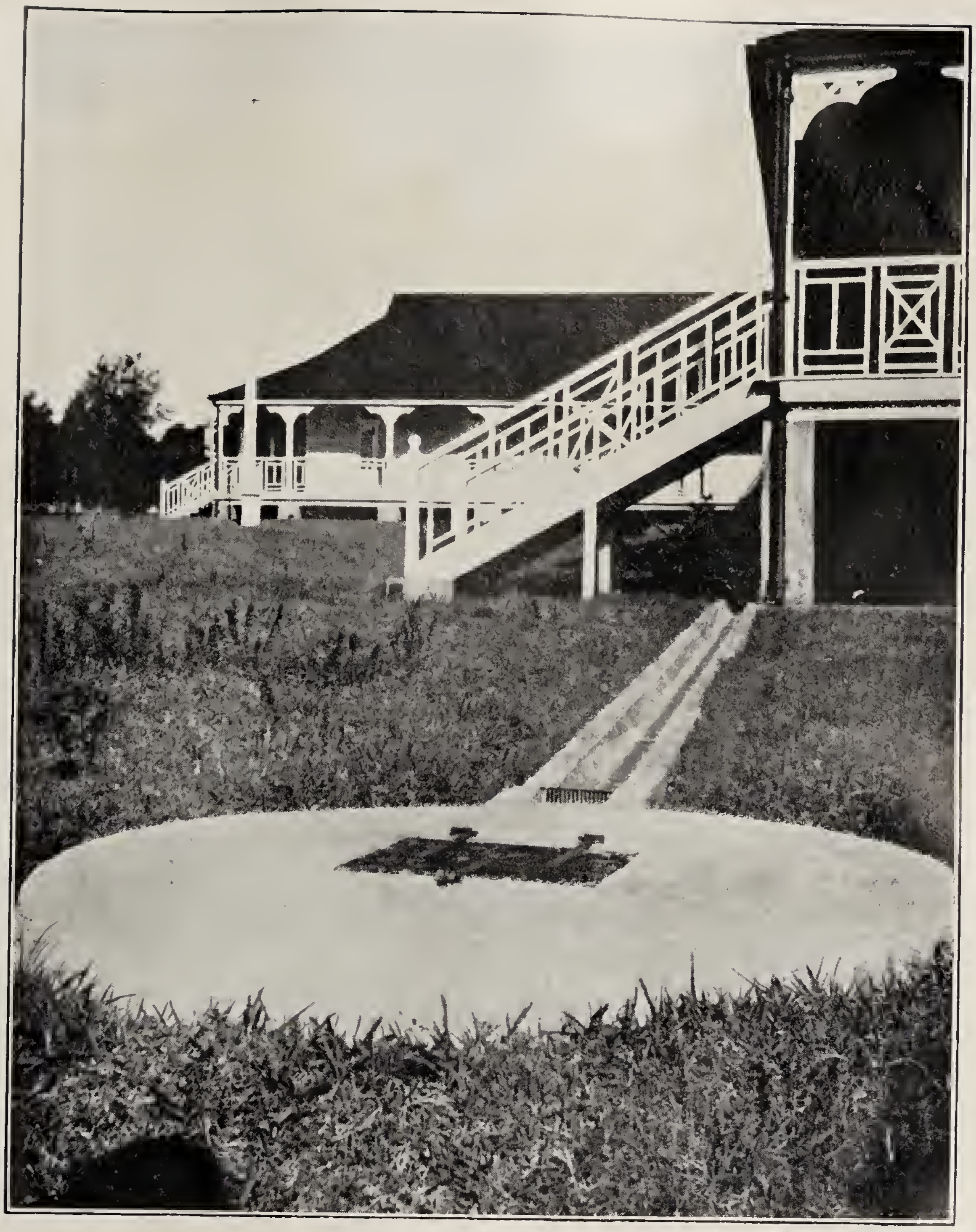
90.—Burning piles of refuse at Port Louis.



91.—Drainage channel from Municipal Slaughter House, Port Louis, blocked with filth.

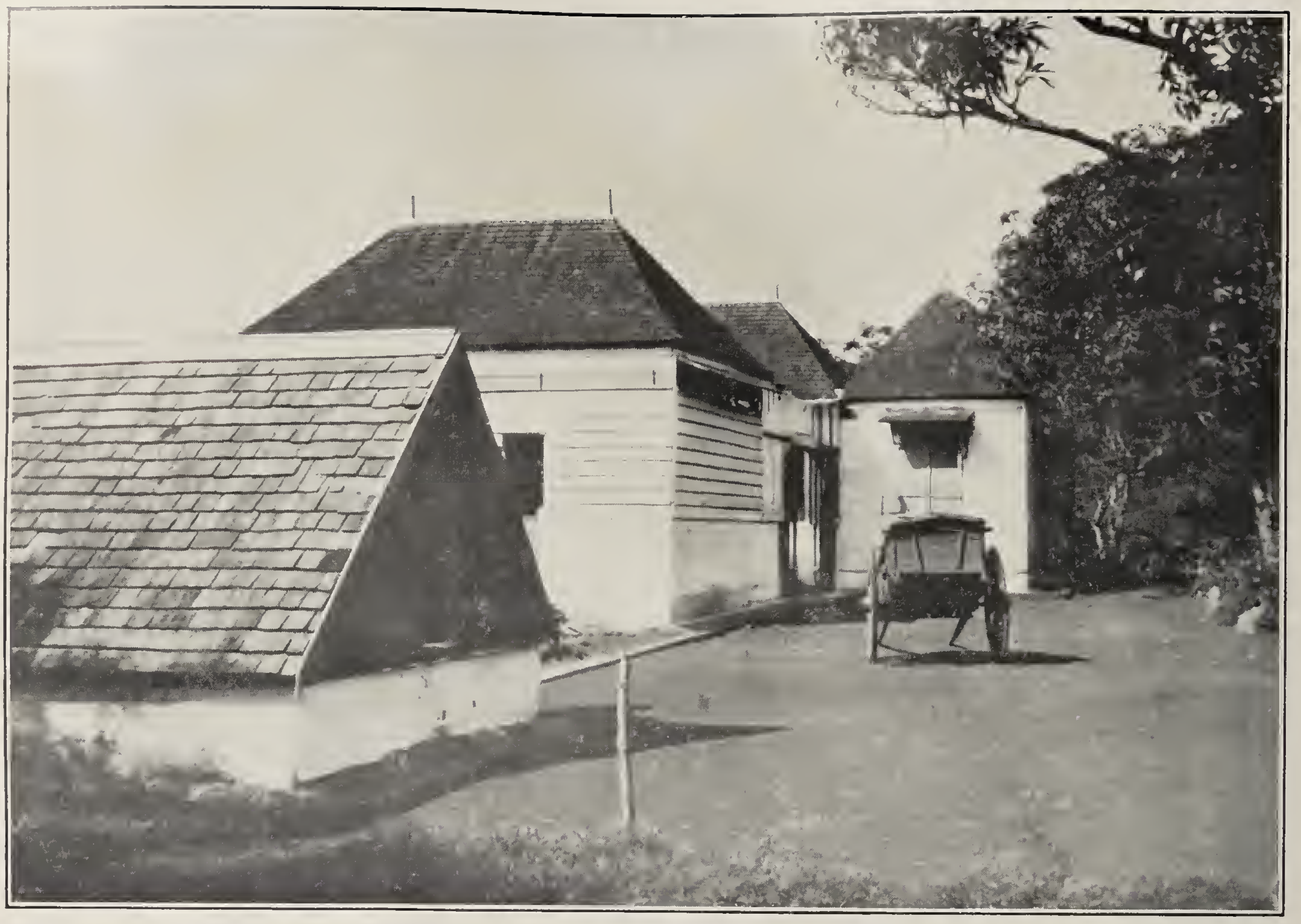


92—Settling tank, Municipal Slaughter House, Port Louis, showing perforated baffle plates.

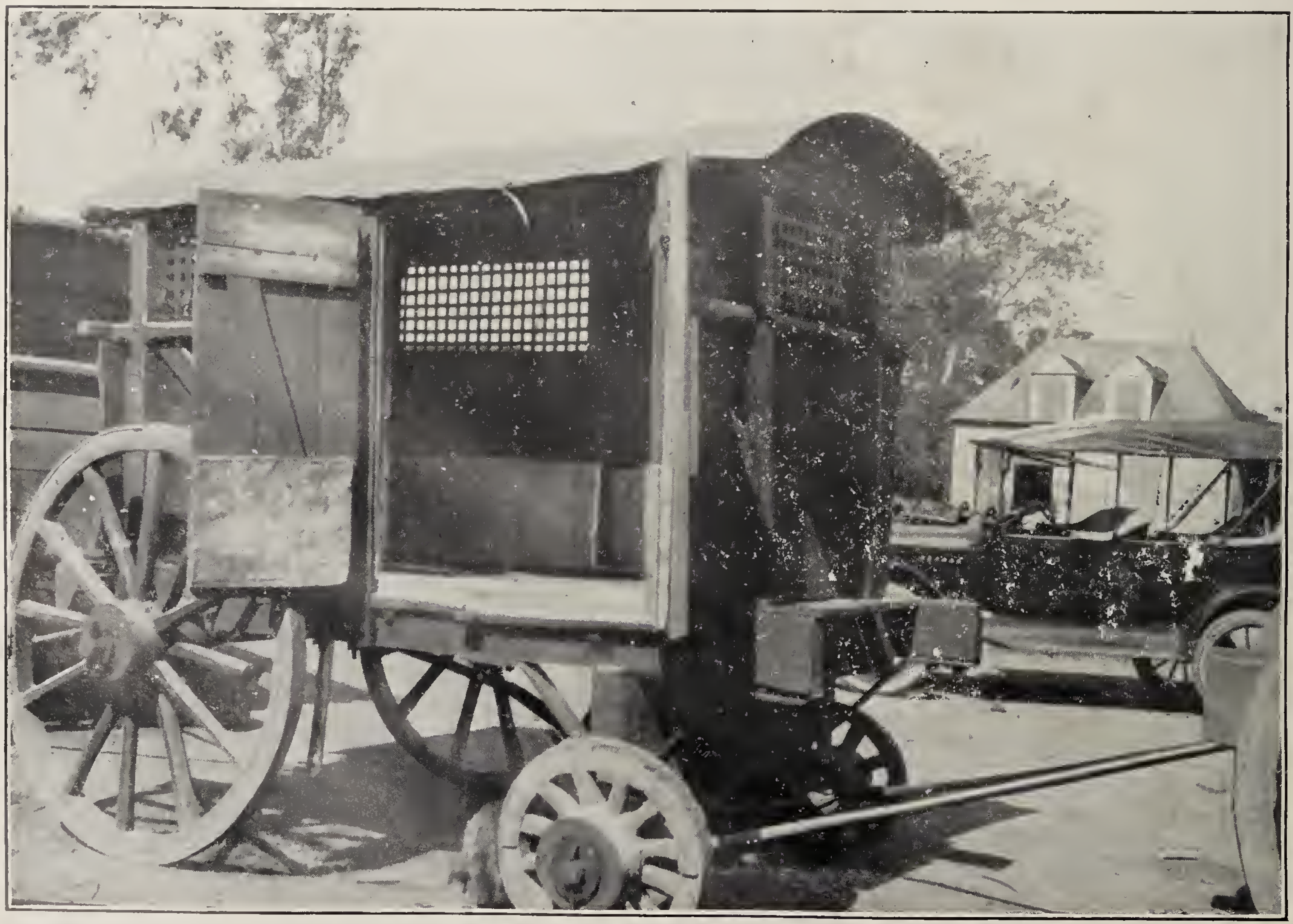


93.—Disposal of waste water. Arrangements at British Barracks at Vacoas. Large covered soak-pit in foreground. The soil here is very porous.

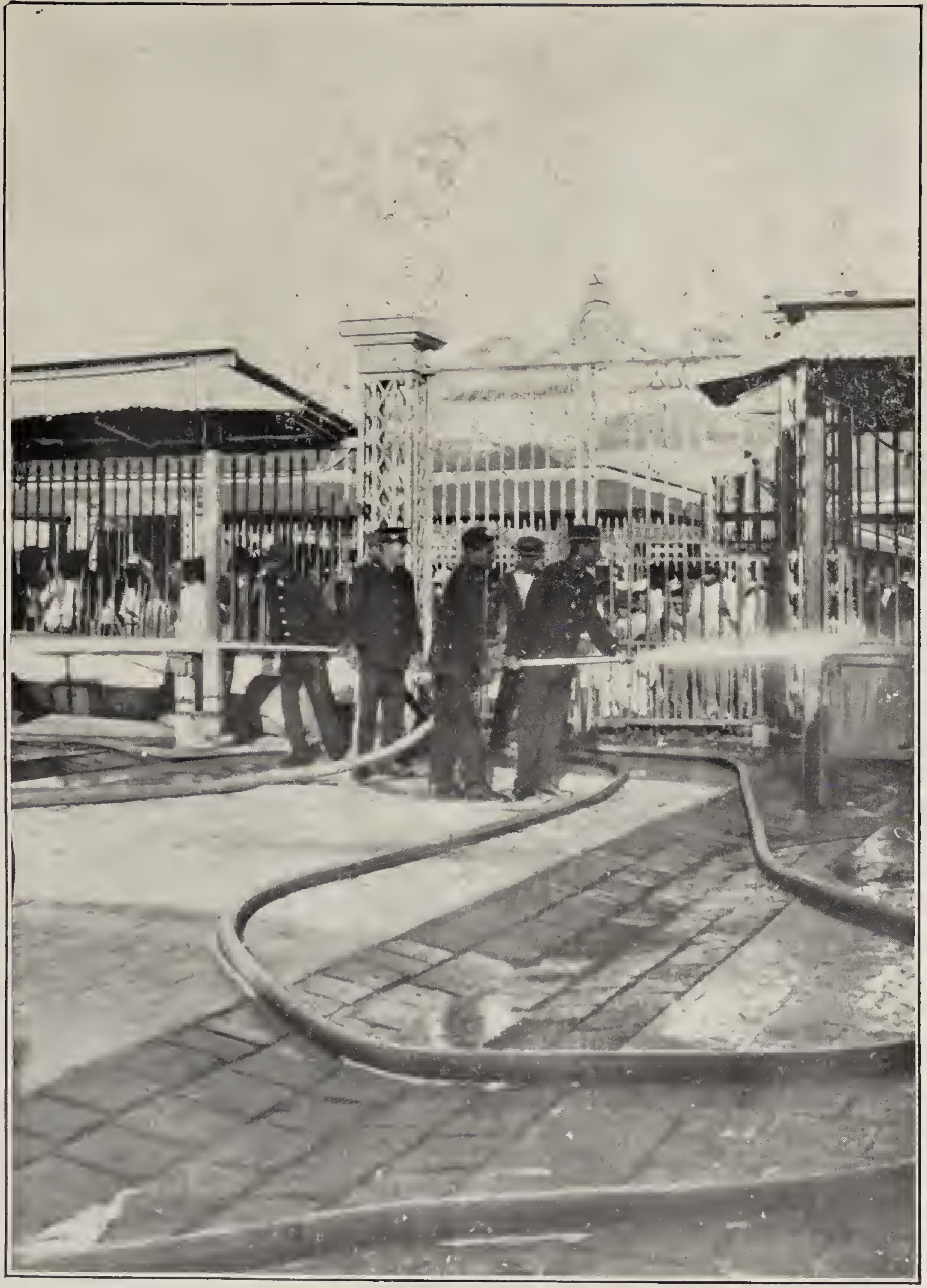
94.—The only slaughter house serving Curepipe. It is privately owned and is a disgrace to the town.



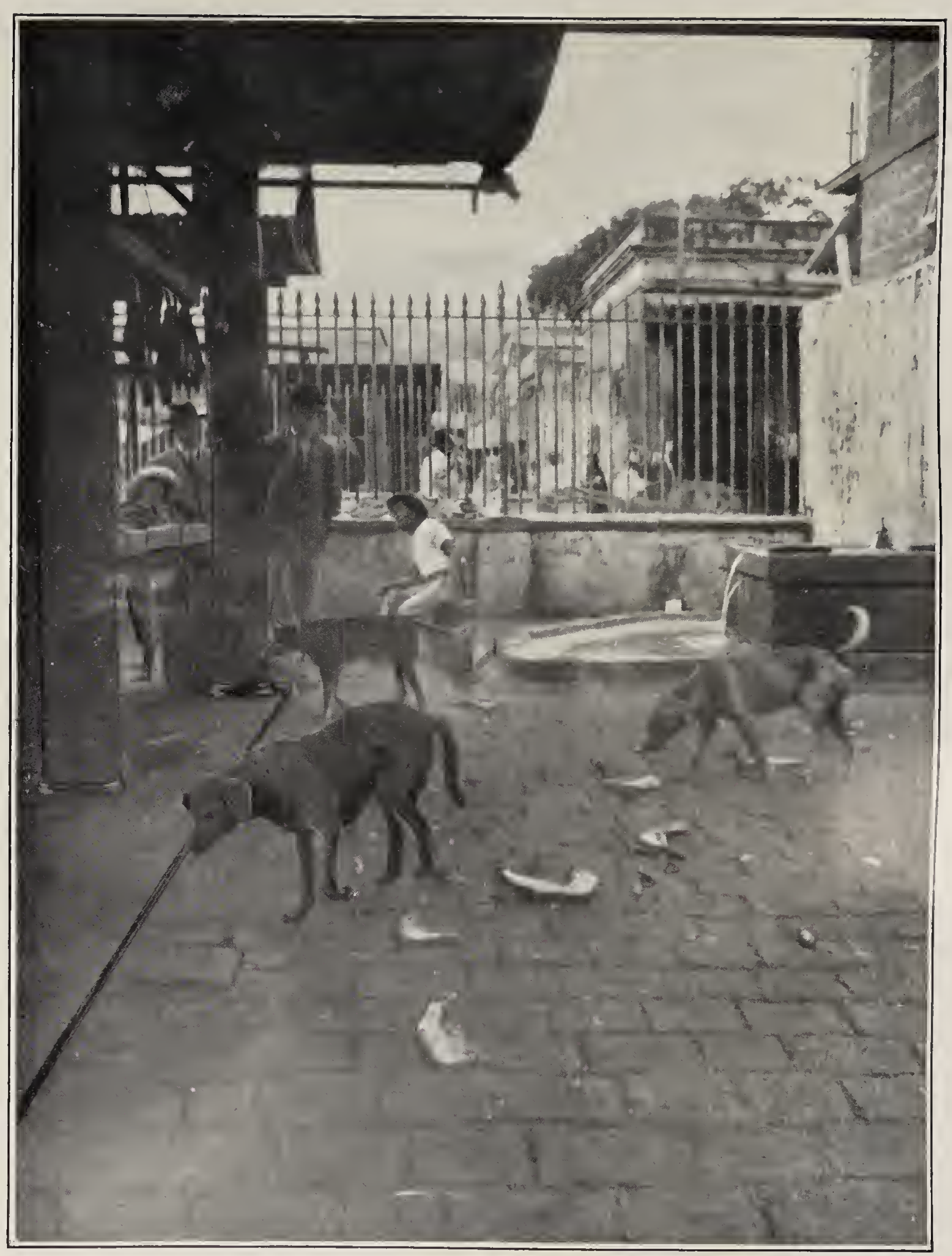
95.—Slaughter House, Mahebourg, showing on the left underground offal and manure pit which is covered and practically fly proof.



96.—A strange and antiquated vehicle employed for conveying meat from the slaughter house to the market, Port Louis. It is lined with zinc but, as will be seen, the fly-proofing is distinctly defective. As a matter of fact the gratings are more for ventilation than for the exclusion of flies.

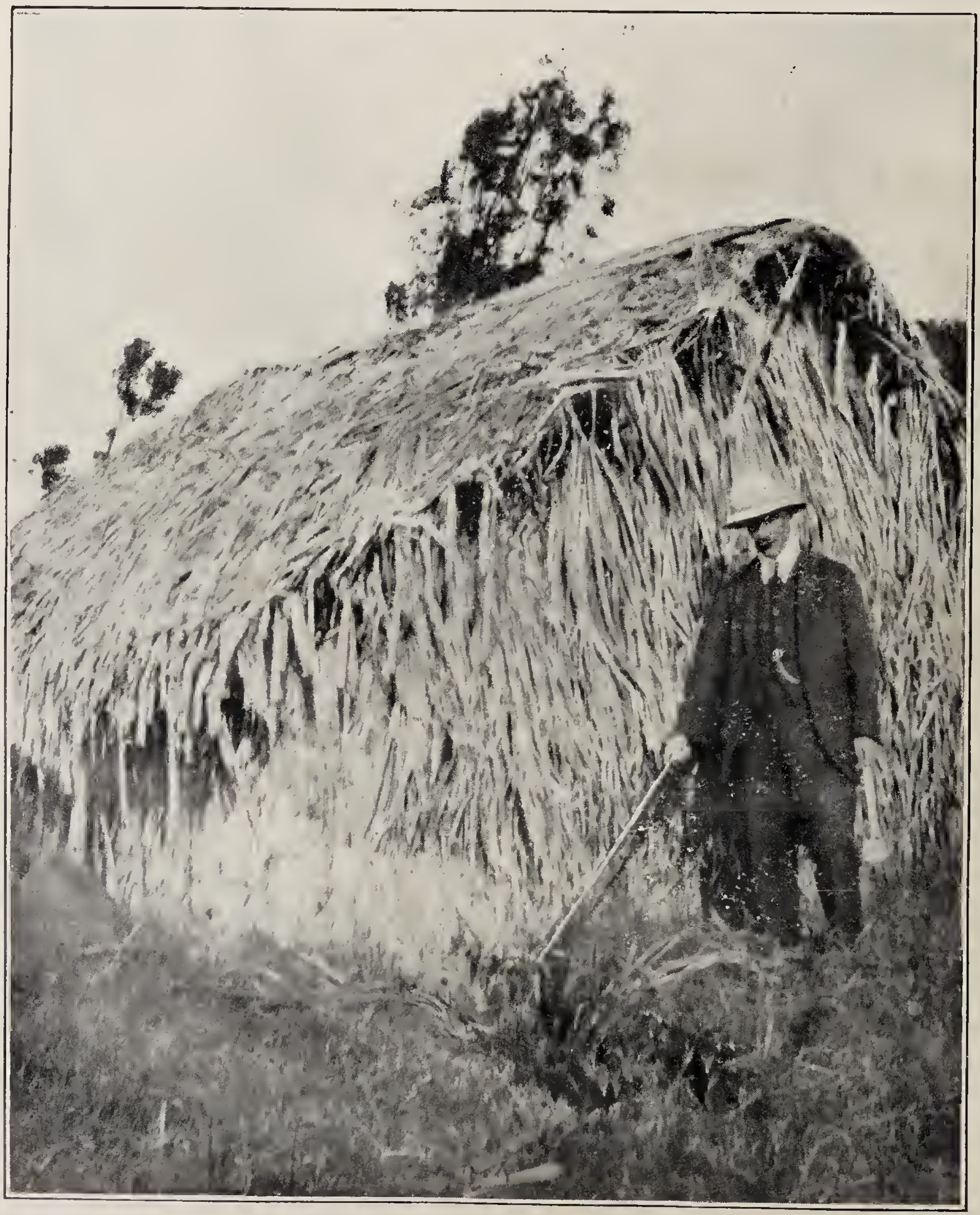


97.—Municipal Fire Brigade cleansing Central Market, Port Louis.

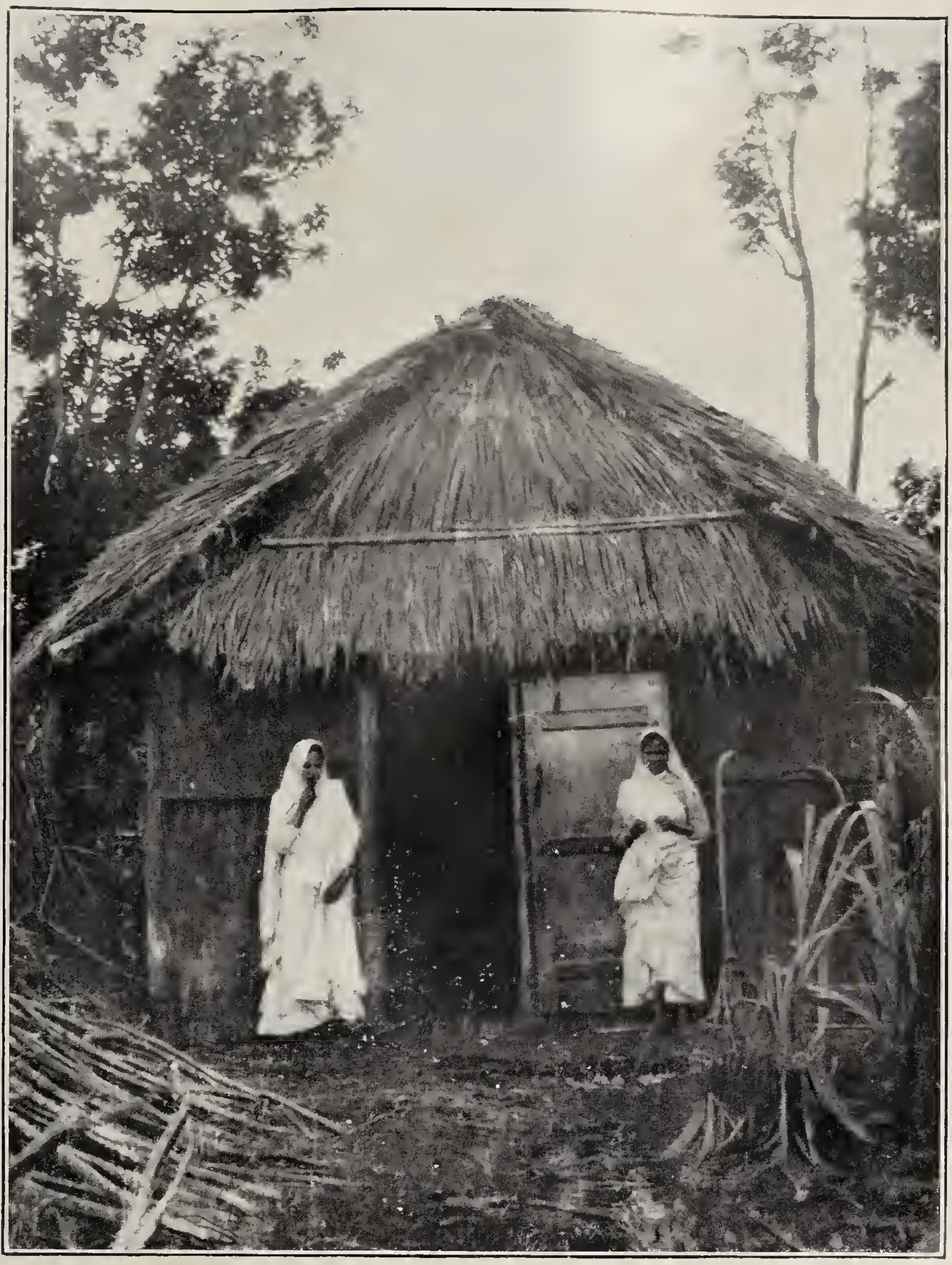


98.—A corner of the Central Meat Market, Port Louis. Note the bones littering the pavement and the stray dogs which foul it.

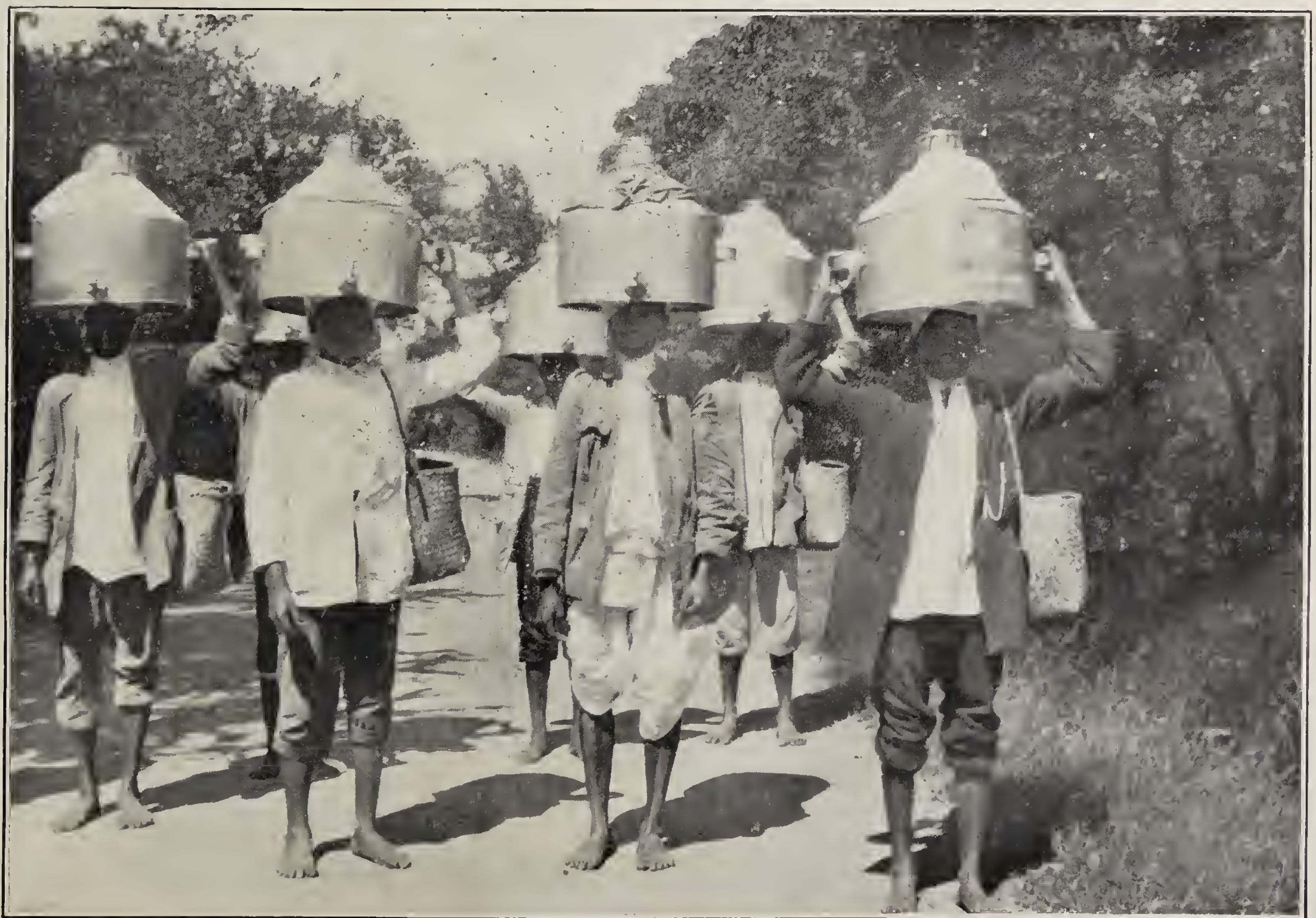
99.—Large covered market at Curepipe. This is the only really good market in Mauritius.



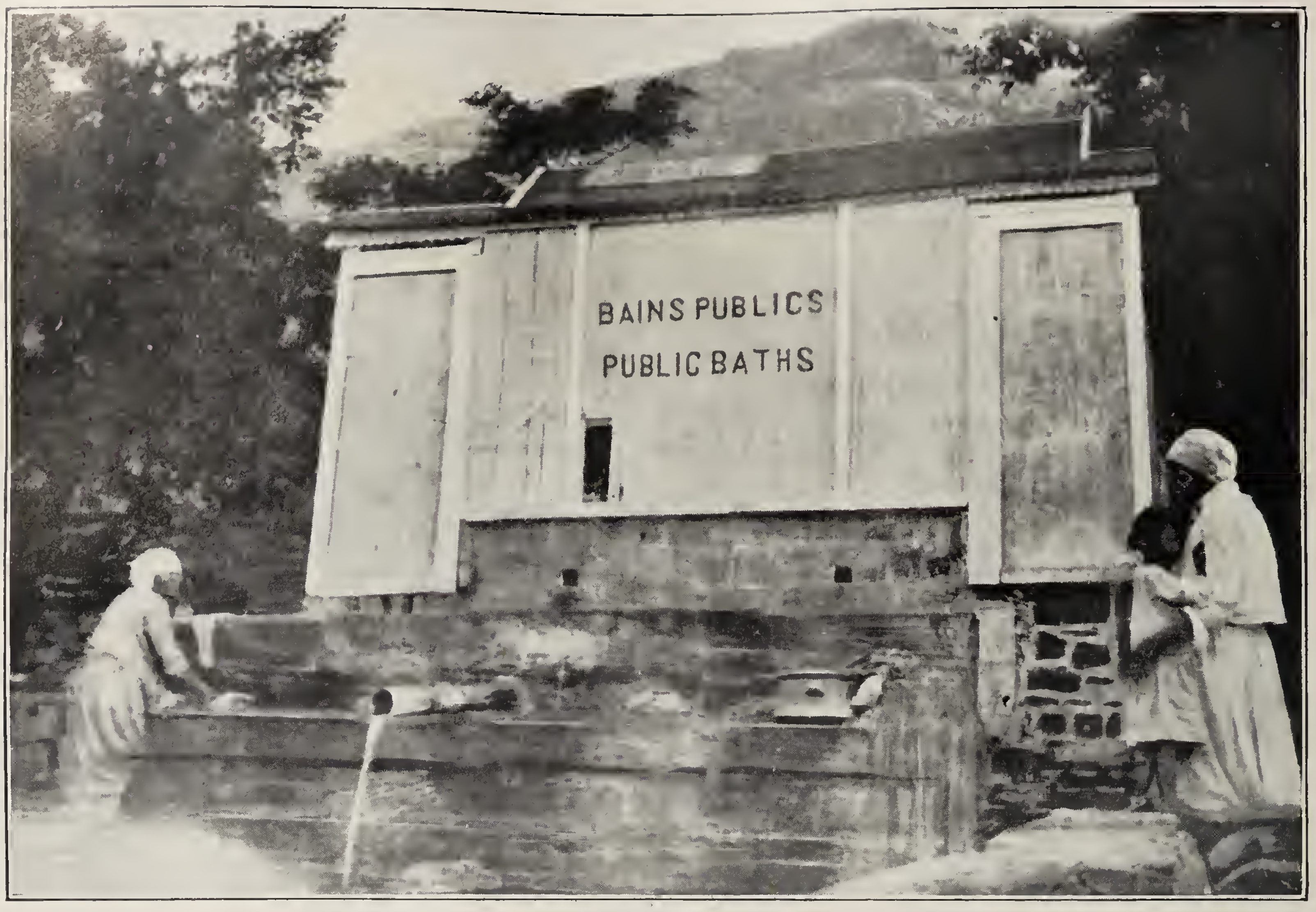
100.—Common type of Indian cow shed The stick indicates the open drainage pit.



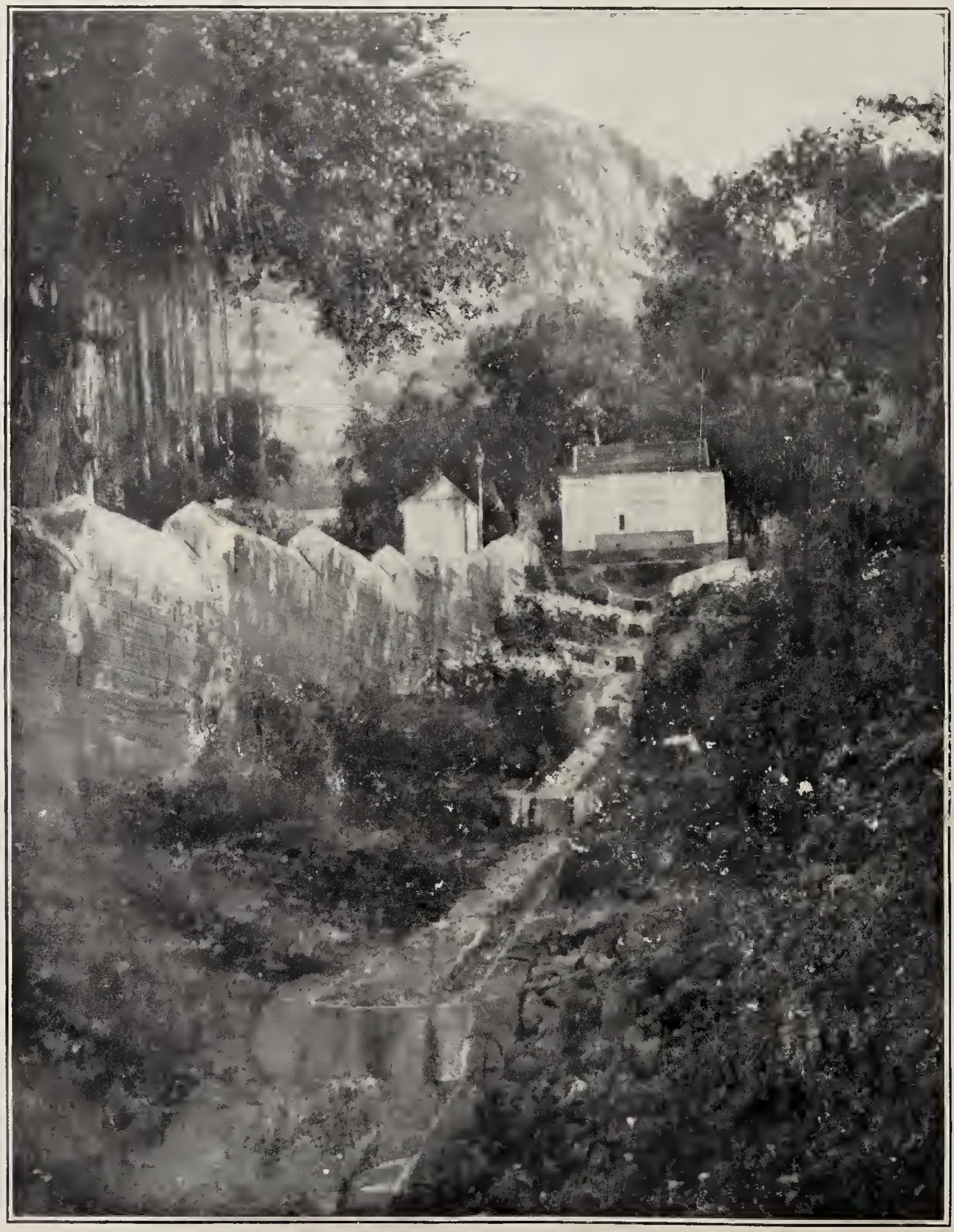
101.—Improved type of Indian cow shed.



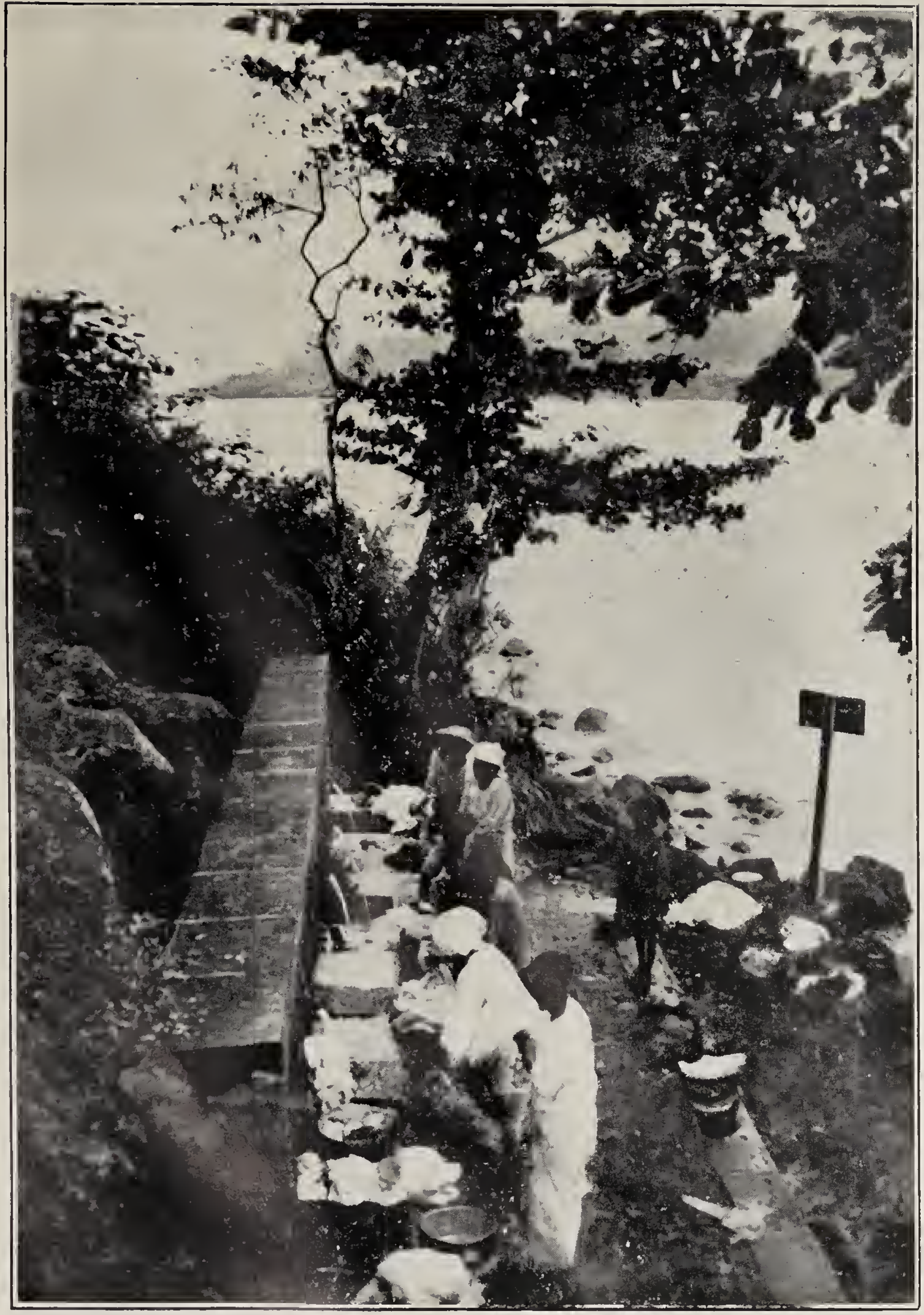
102.—Group of milk vendors. The tins are of fairly good type, but their contents only faintly resemble milk, as the product from the cow has had the fat removed, has been boiled and has had water added to it.



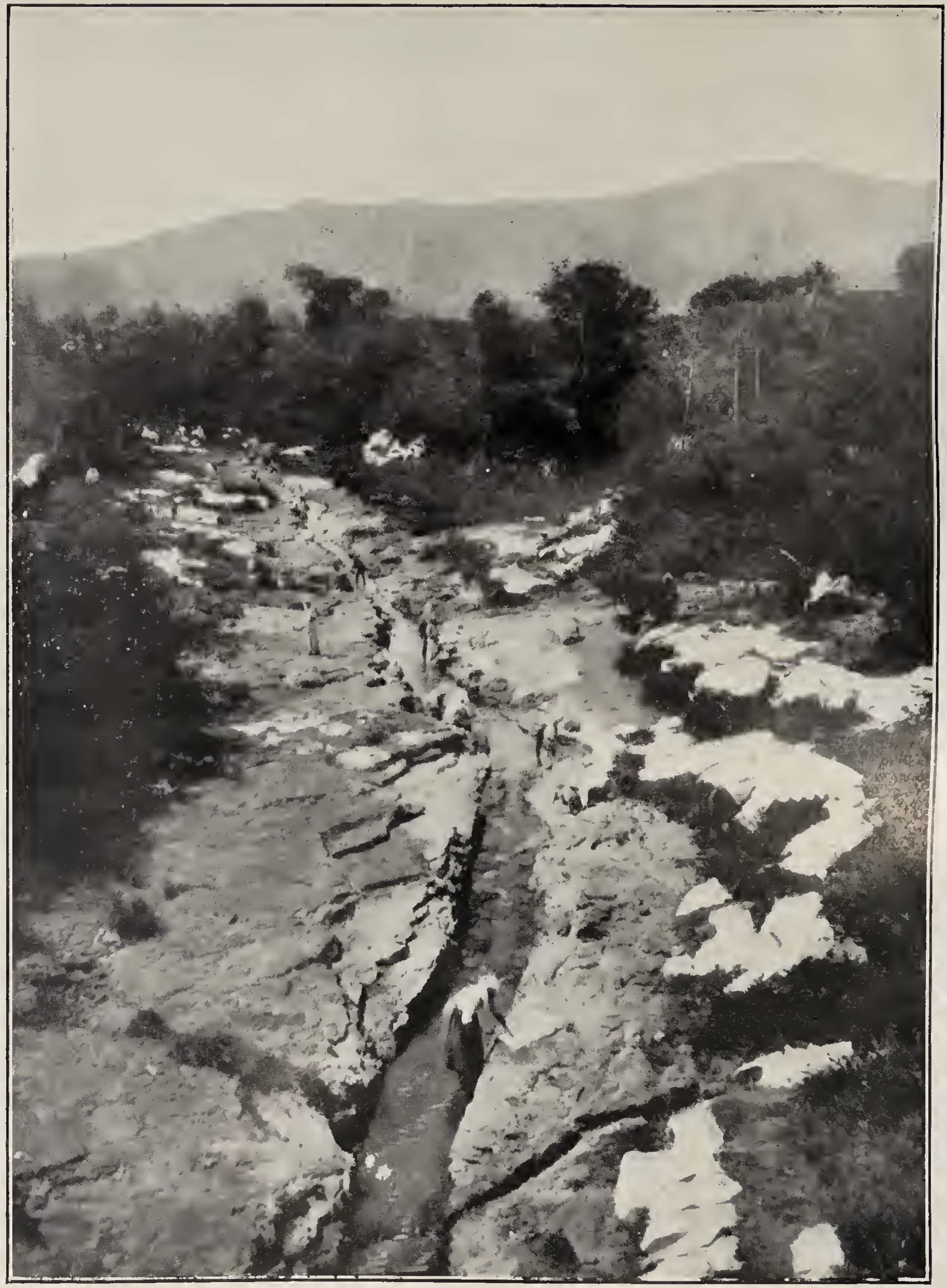
103.—The only public baths in Port Louis



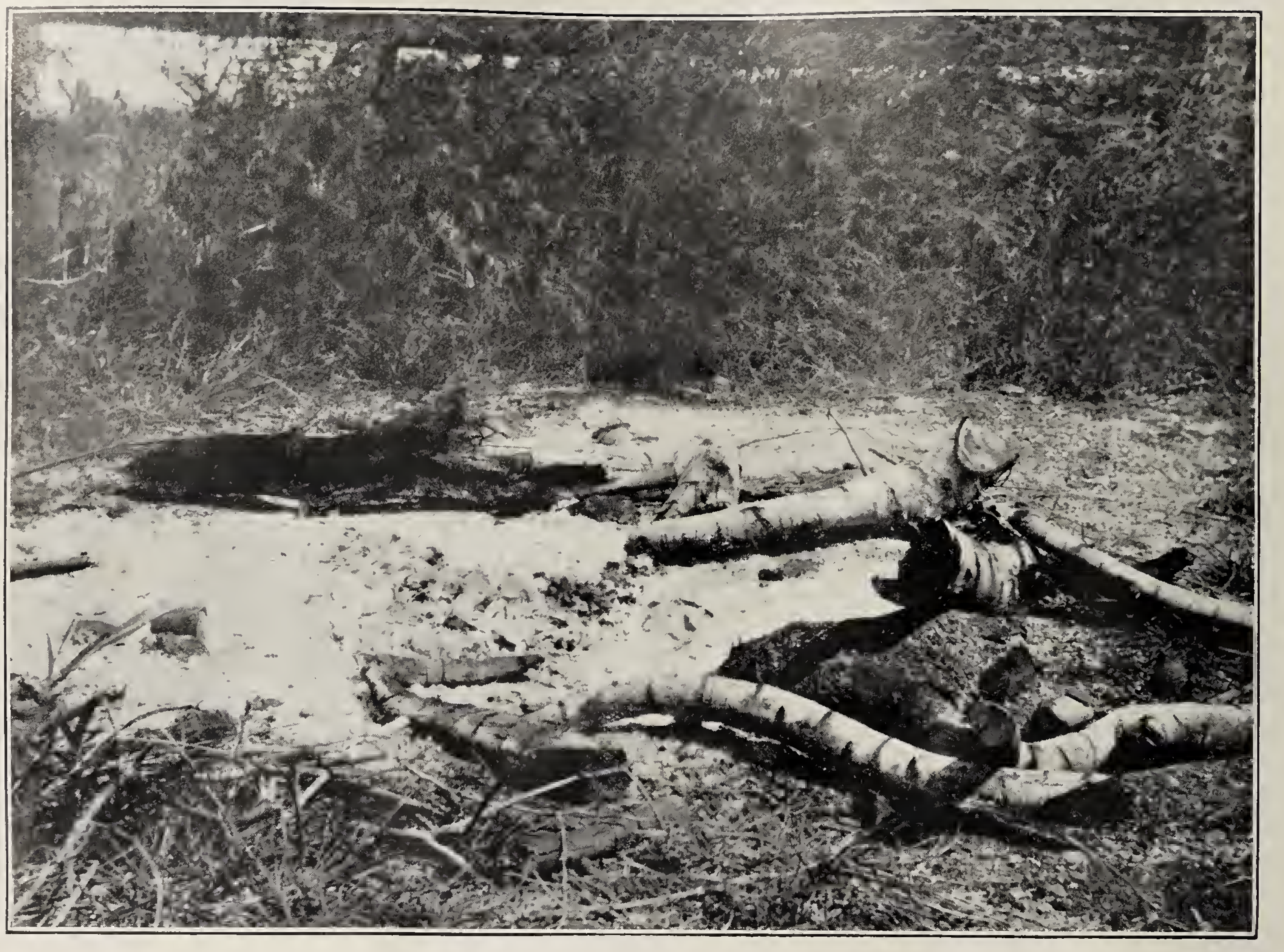
104.—Public baths, Port Louis, showing site on flank of Signal Mountain and drainage.



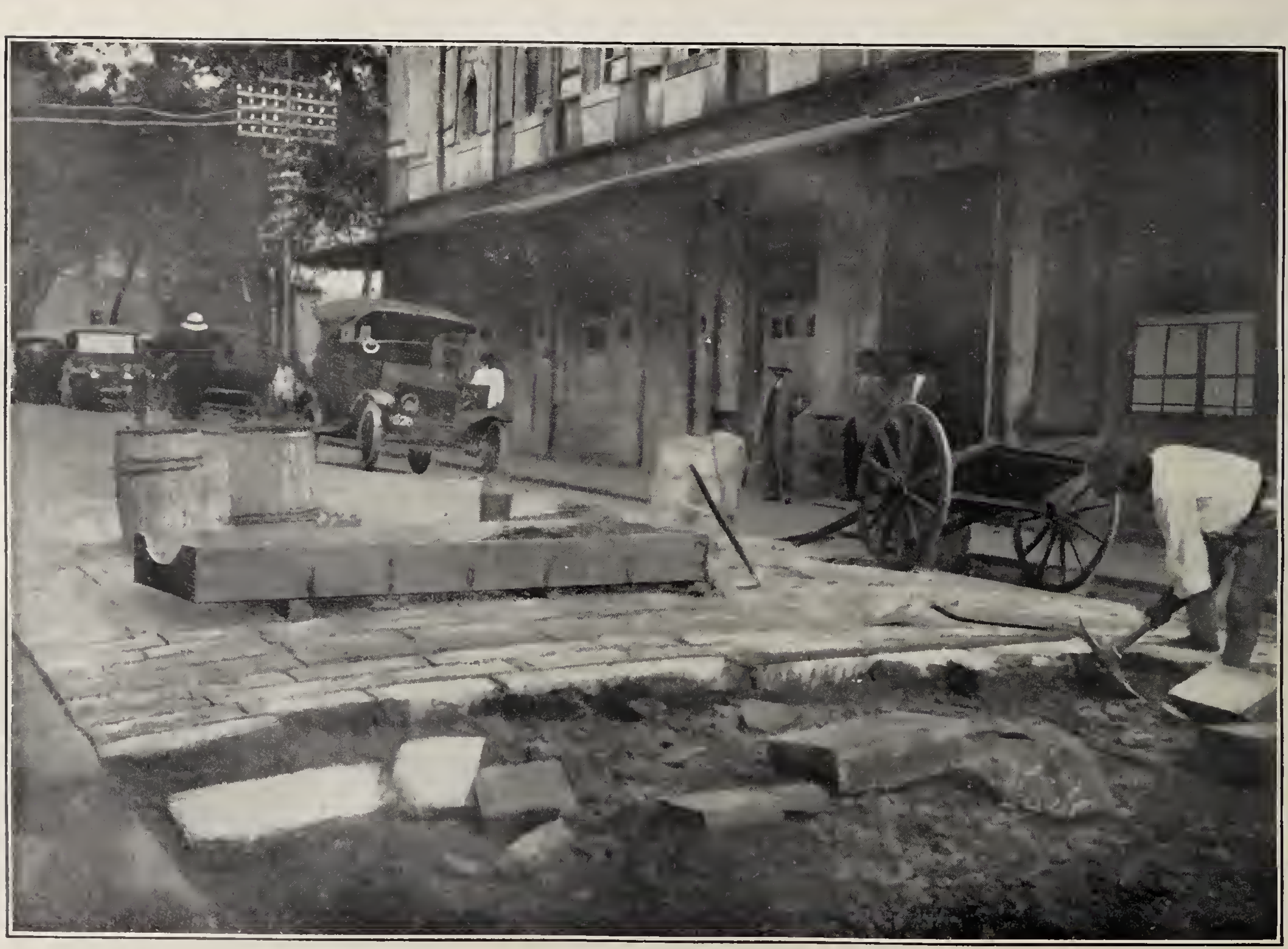
105.—Open air laundry, Souillac, Savanne; drainage to the sea.



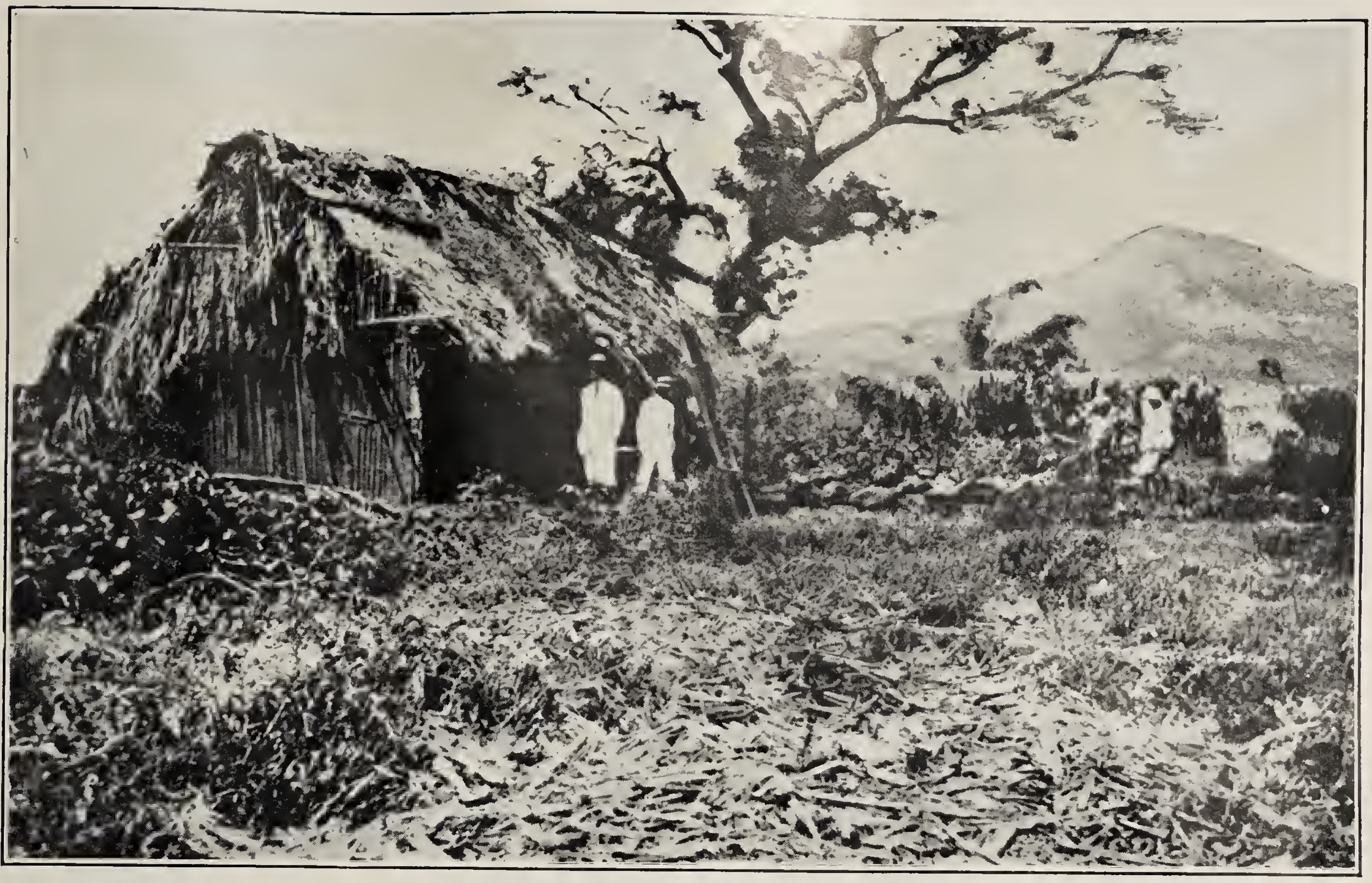
106.—Latanier stream near Port Louis, showing native washer-women at work. This photograph also shows how the stream has been canalised in solid rock.



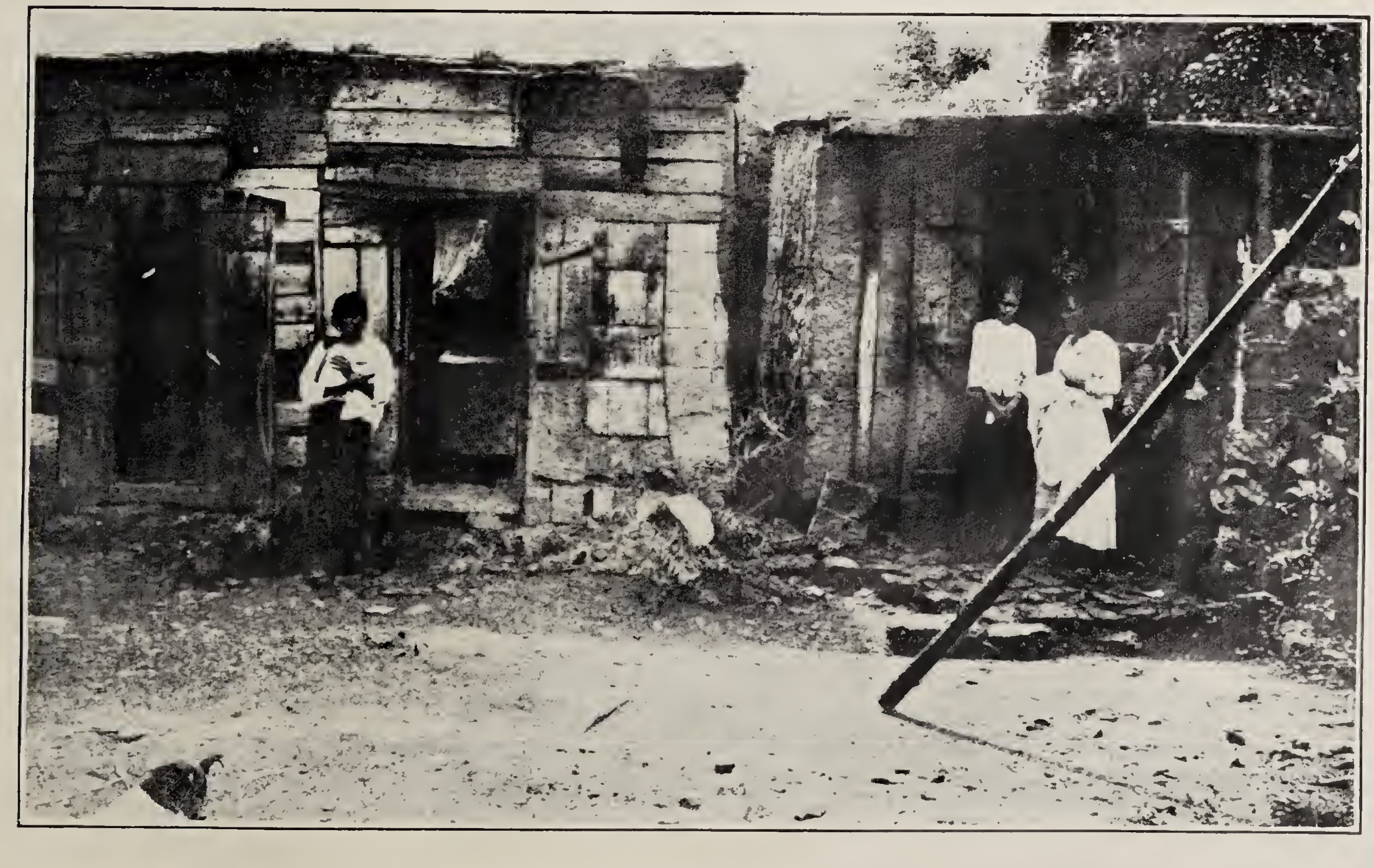
107.—Indian burning ghat, Port Louis. Note ashes *in situ*.



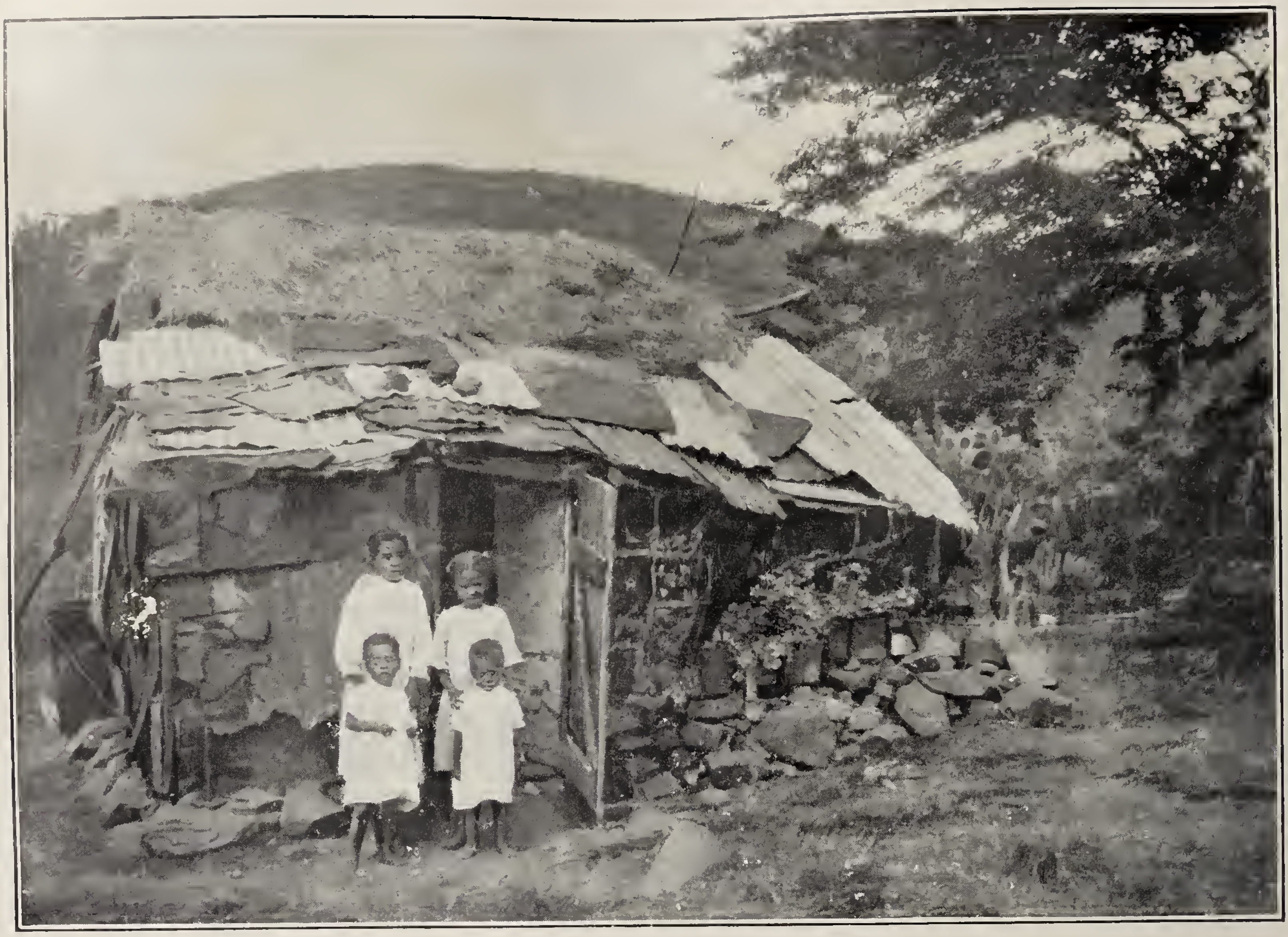
108.—Repairing Queen Street, Port Louis, by means of basalt setts.



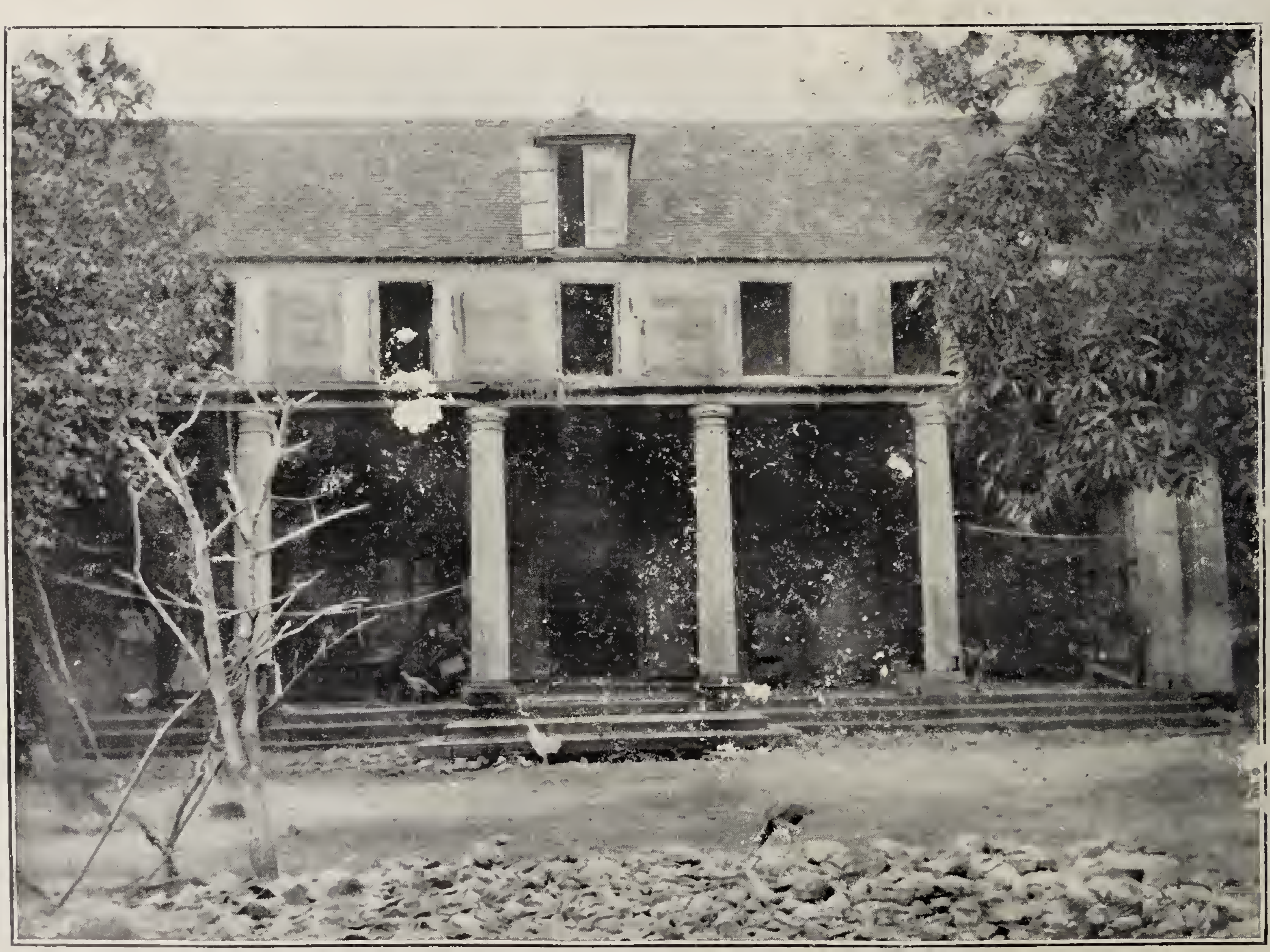
109.—Common type of Creole dwelling. [*Photograph by A. Walter, F.R.A.S.*]



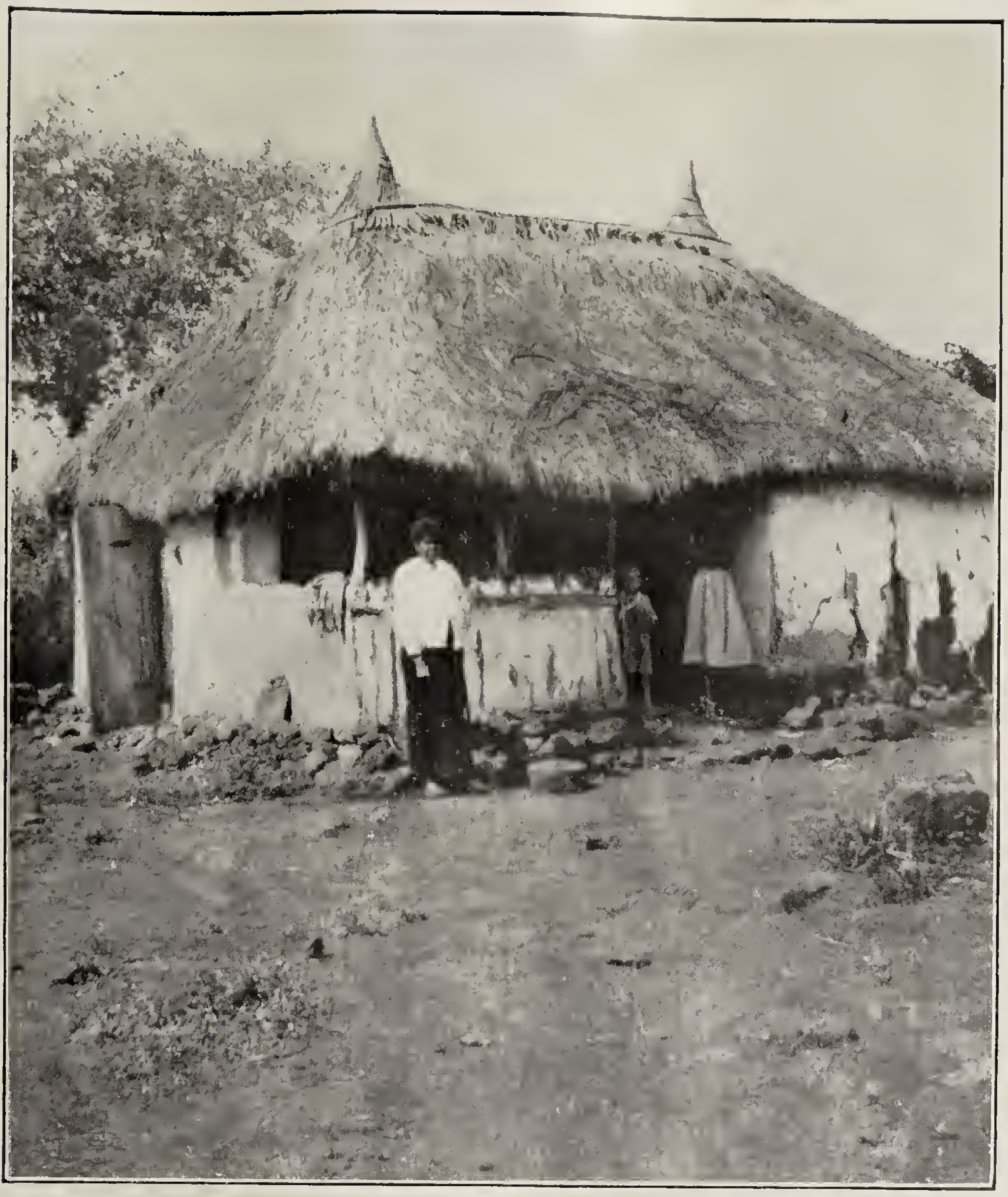
110.—Creole shacks on outskirts of Port Louis. Nine persons occupied the central room. [*Photograph by A. Walter, F.R.A S.*]



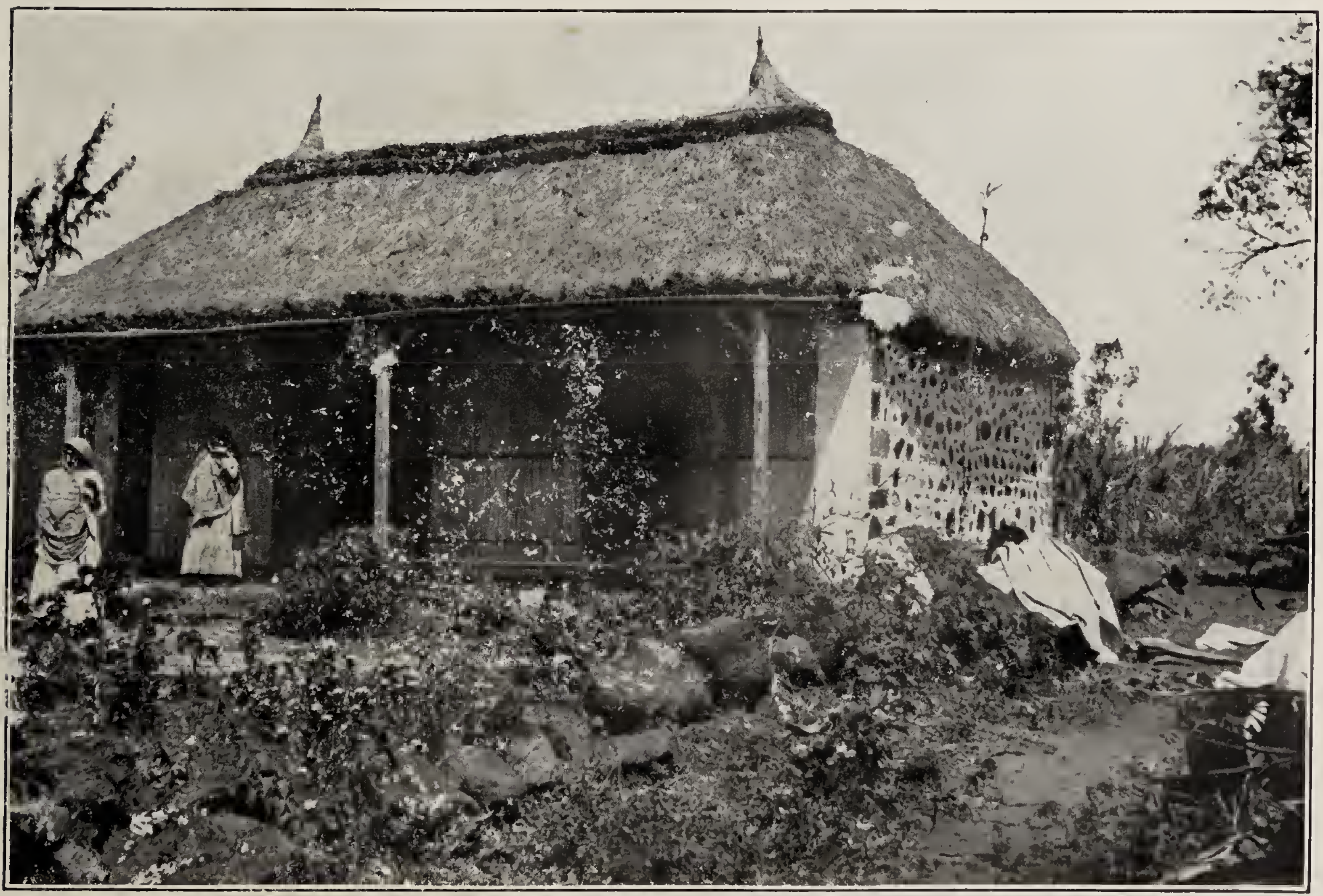
111.—An improvised Creole dwelling; outskirts of Port Louis.



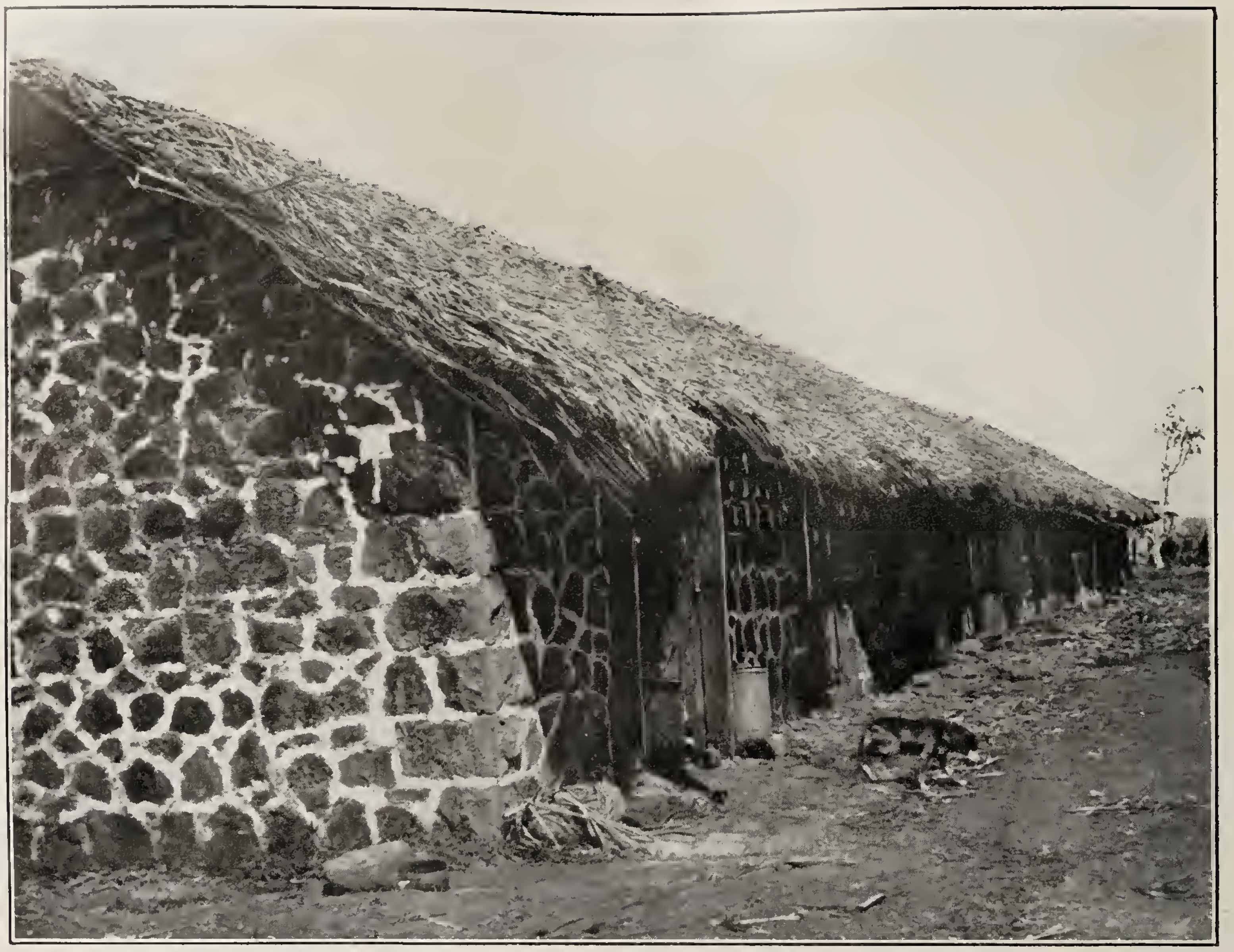
112.—Fine old mansion, Port Louis. Now a common lodging house of a better class.



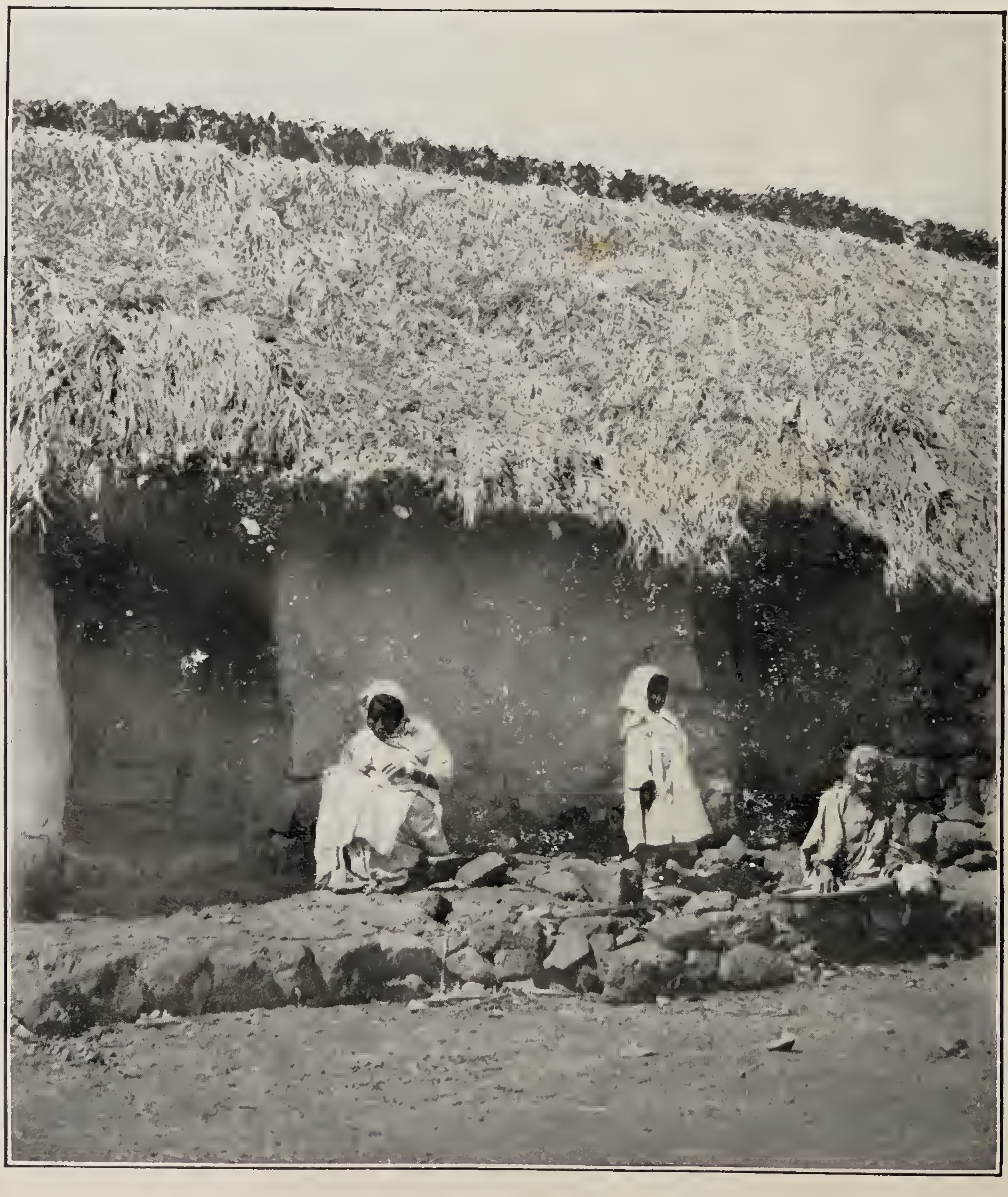
113.—Creole fisherman's hut, Pointe-aux-Piments.



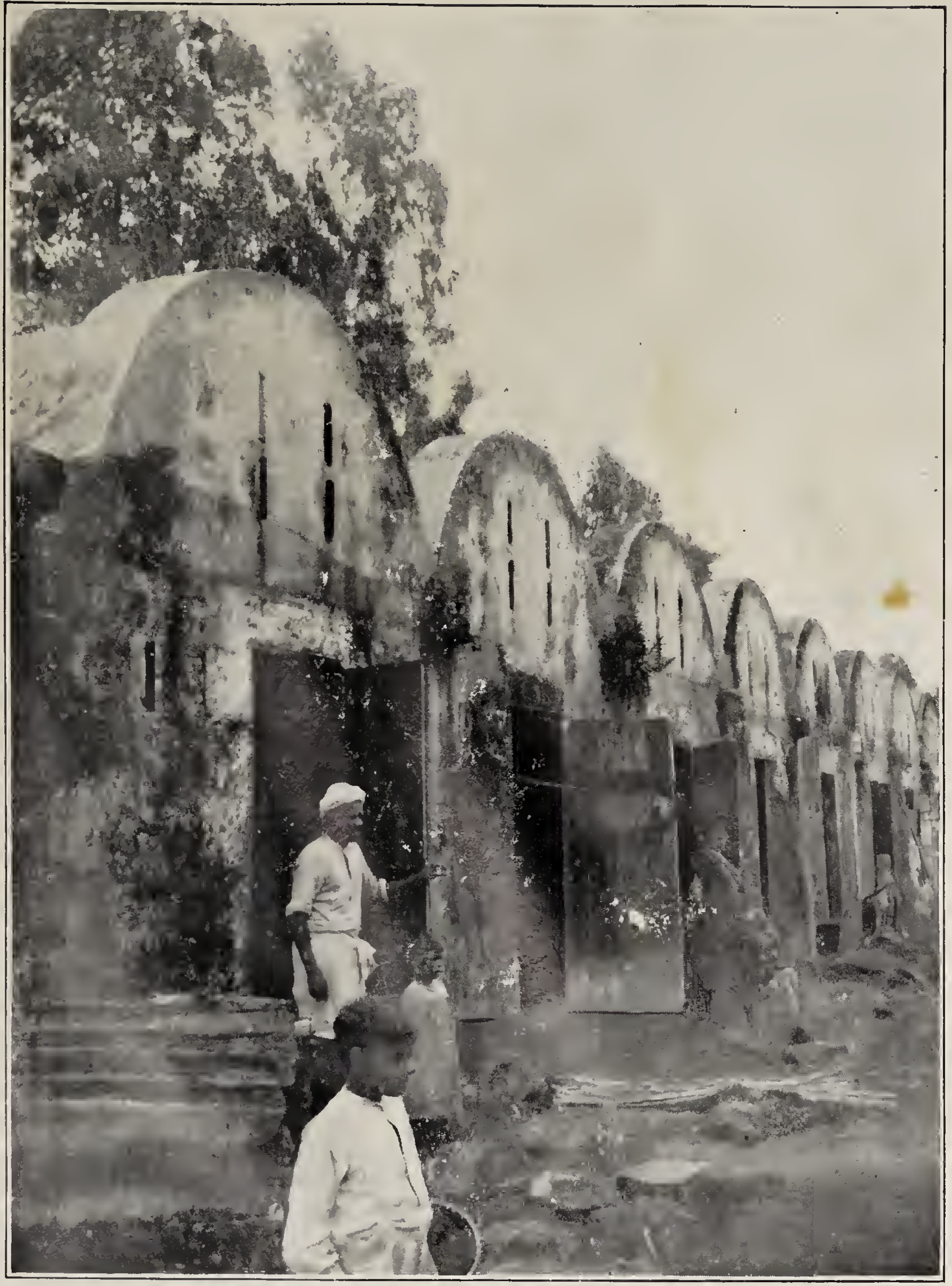
114.—Type of better class Indian's house.



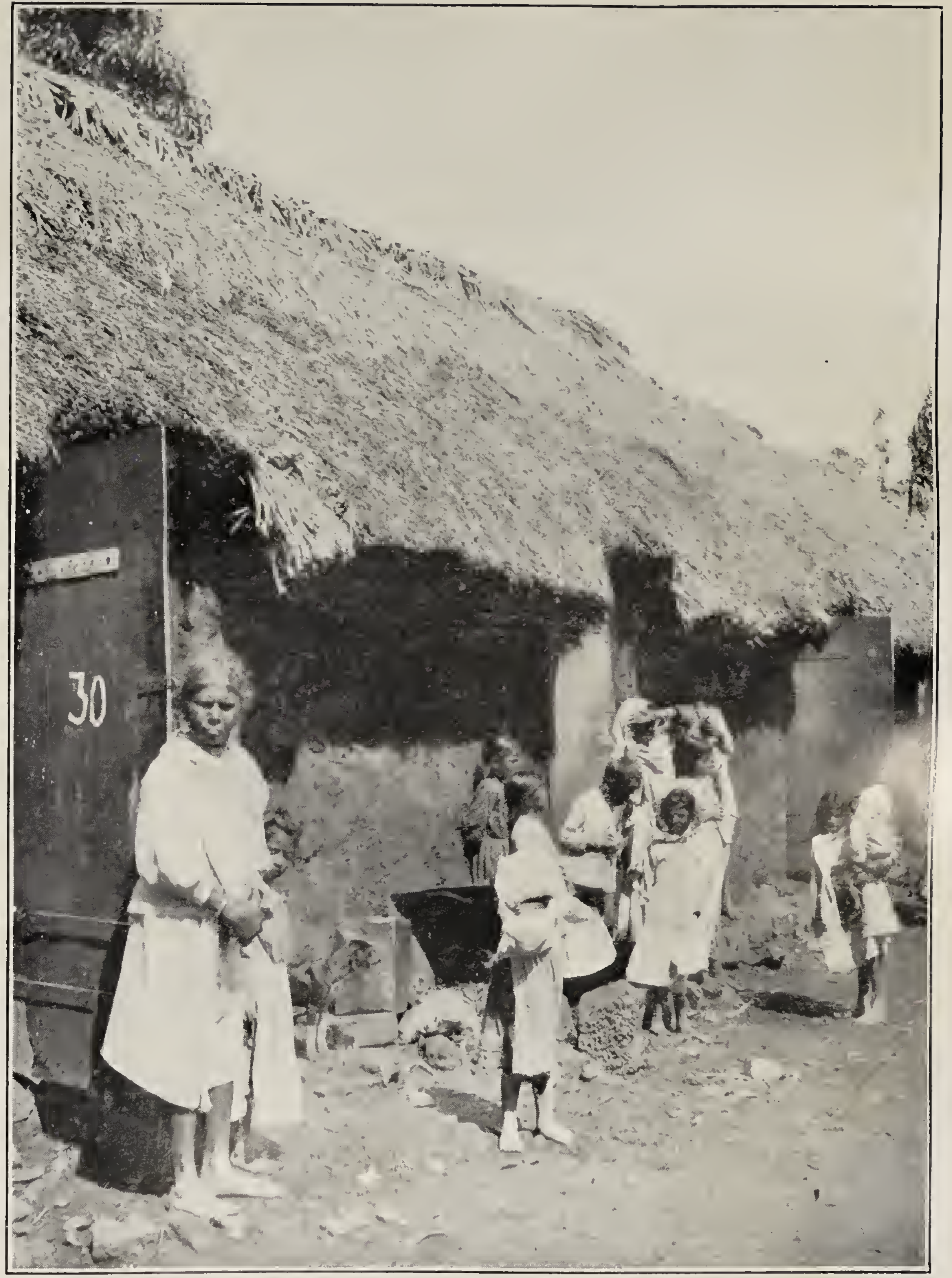
115.—Bad type of coolie lines sugar estate, Moka. Note absence of windows.



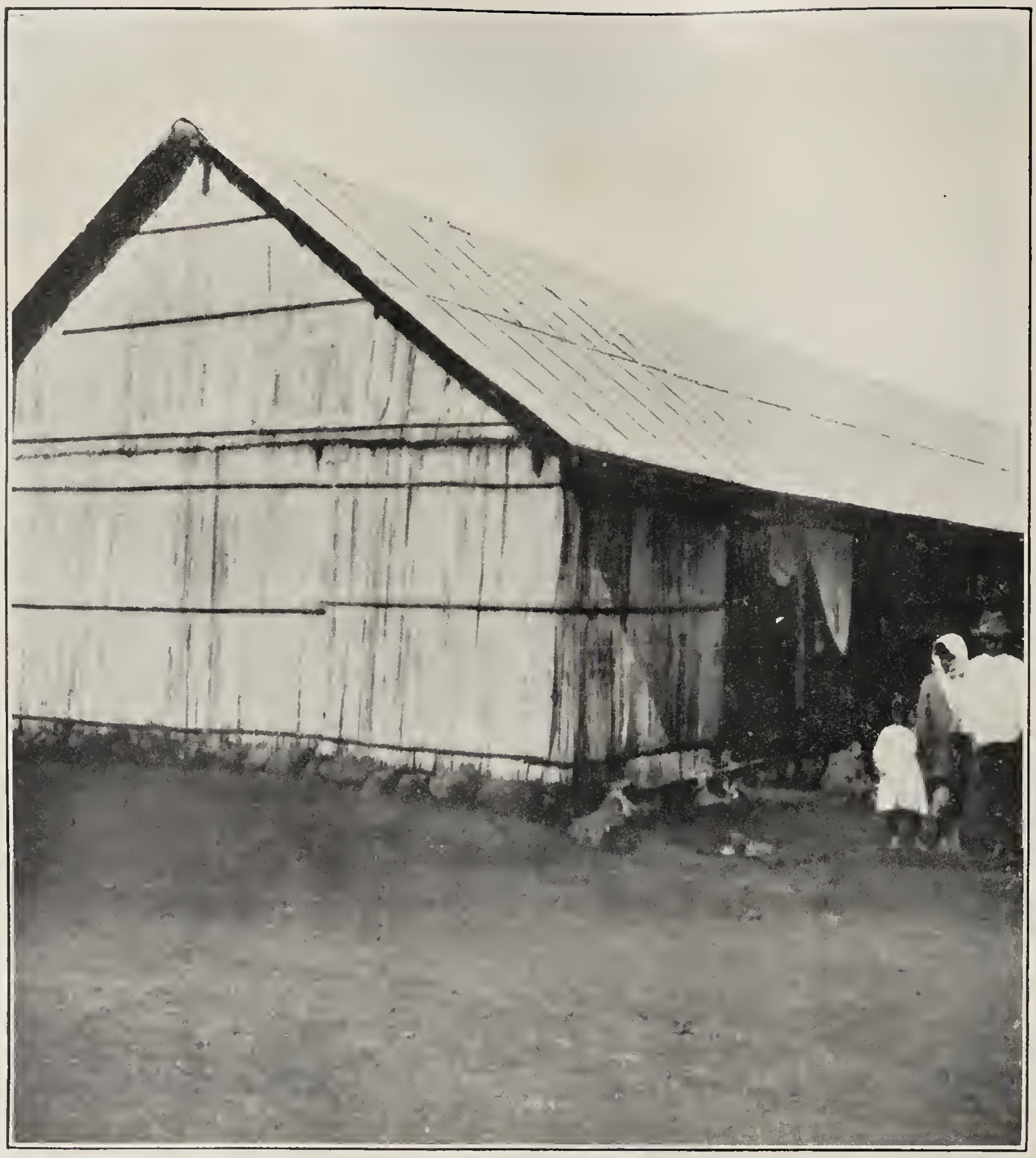
116.—Old and bad type of coolie lines, sugar estate, Moka. Note absence of windows.



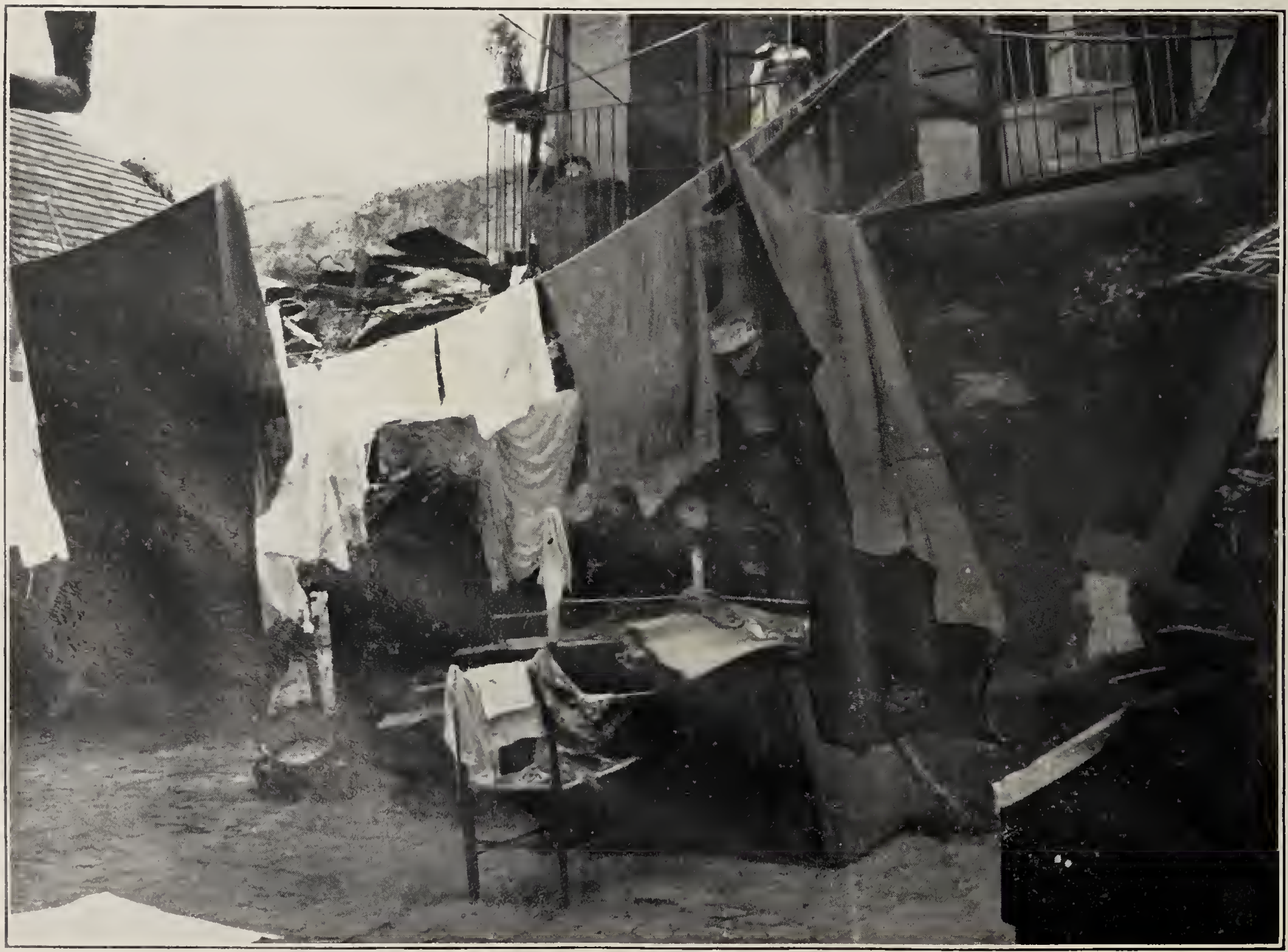
117.—Vault-like type of coolie lines. This form is no longer constructed, but such lines are still occupied on several estates.



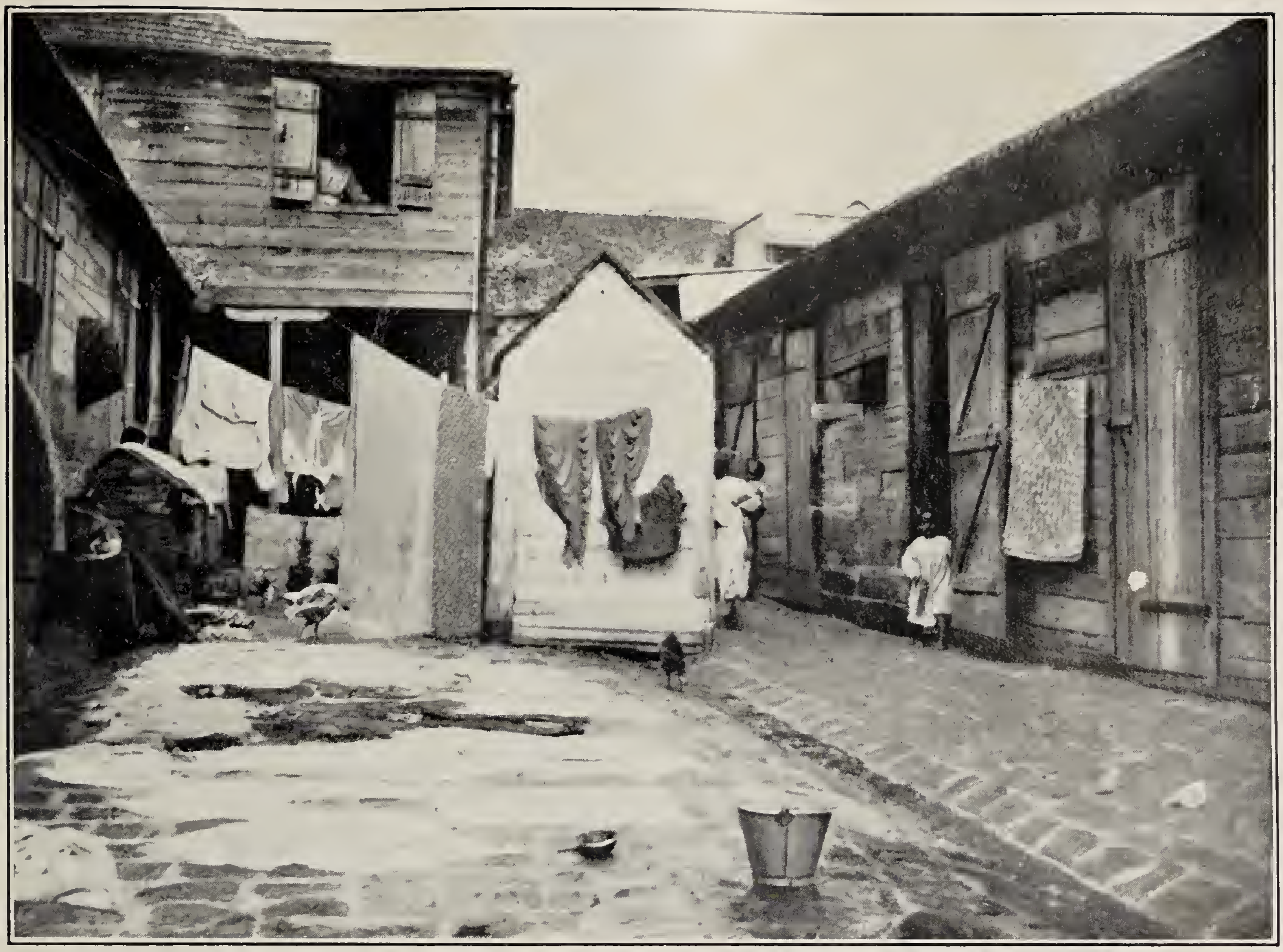
118.—Coolie lines furnished with metal doors. Note absence of windows.



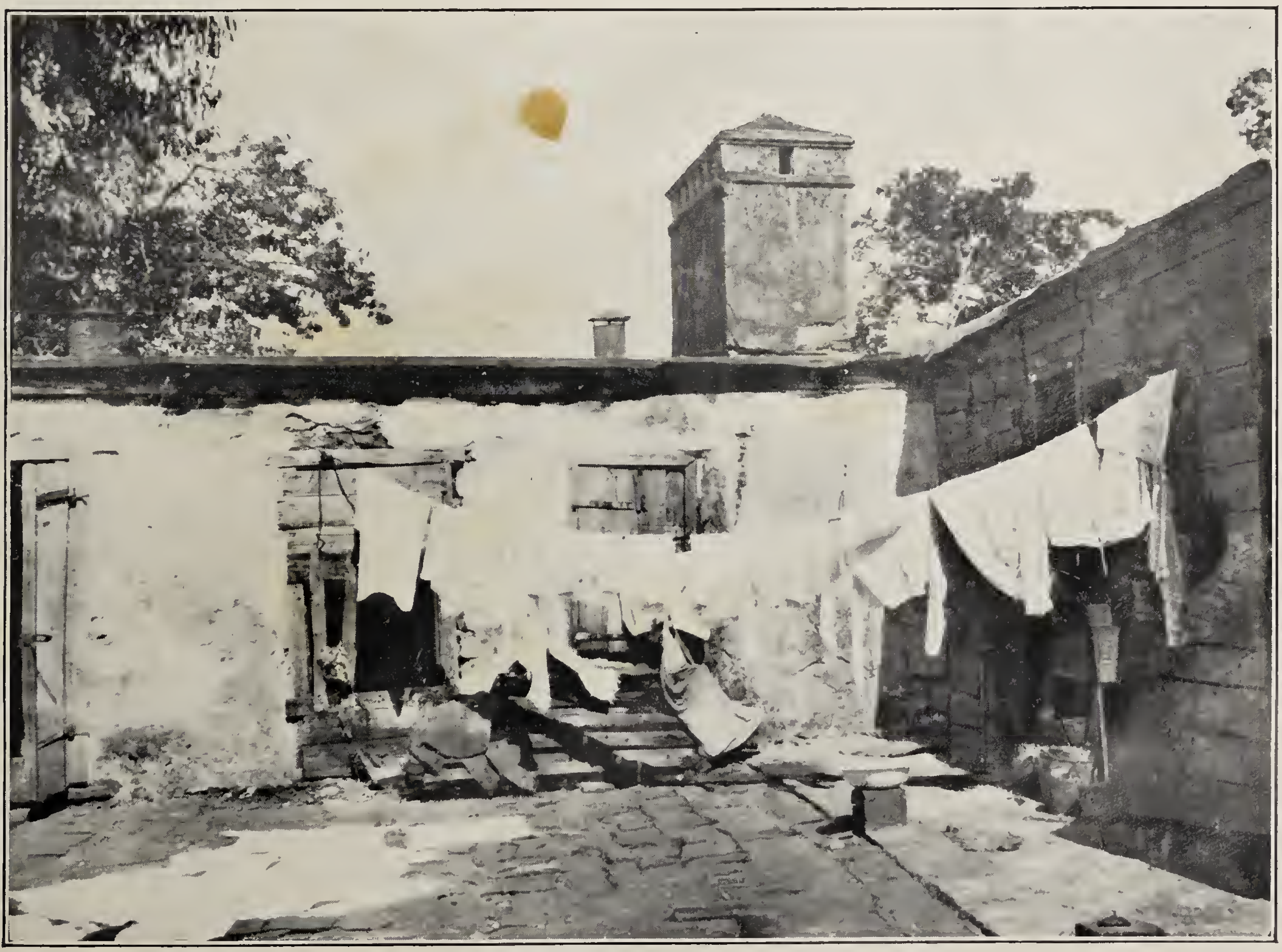
119.—New type of coolie line with walls of ravenal boarding and roof of poilite.



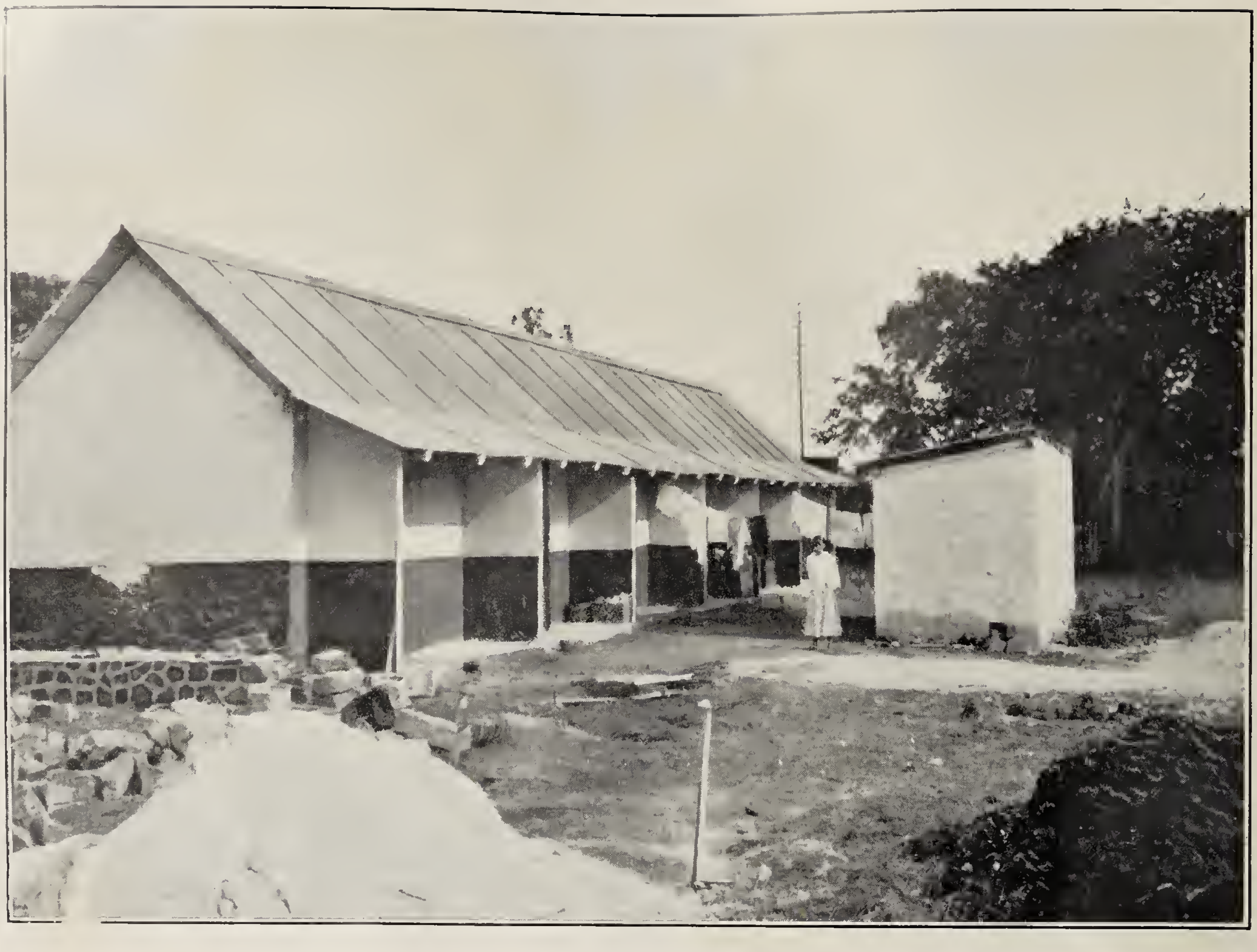
120.—Insanitary yard, Port Louis.



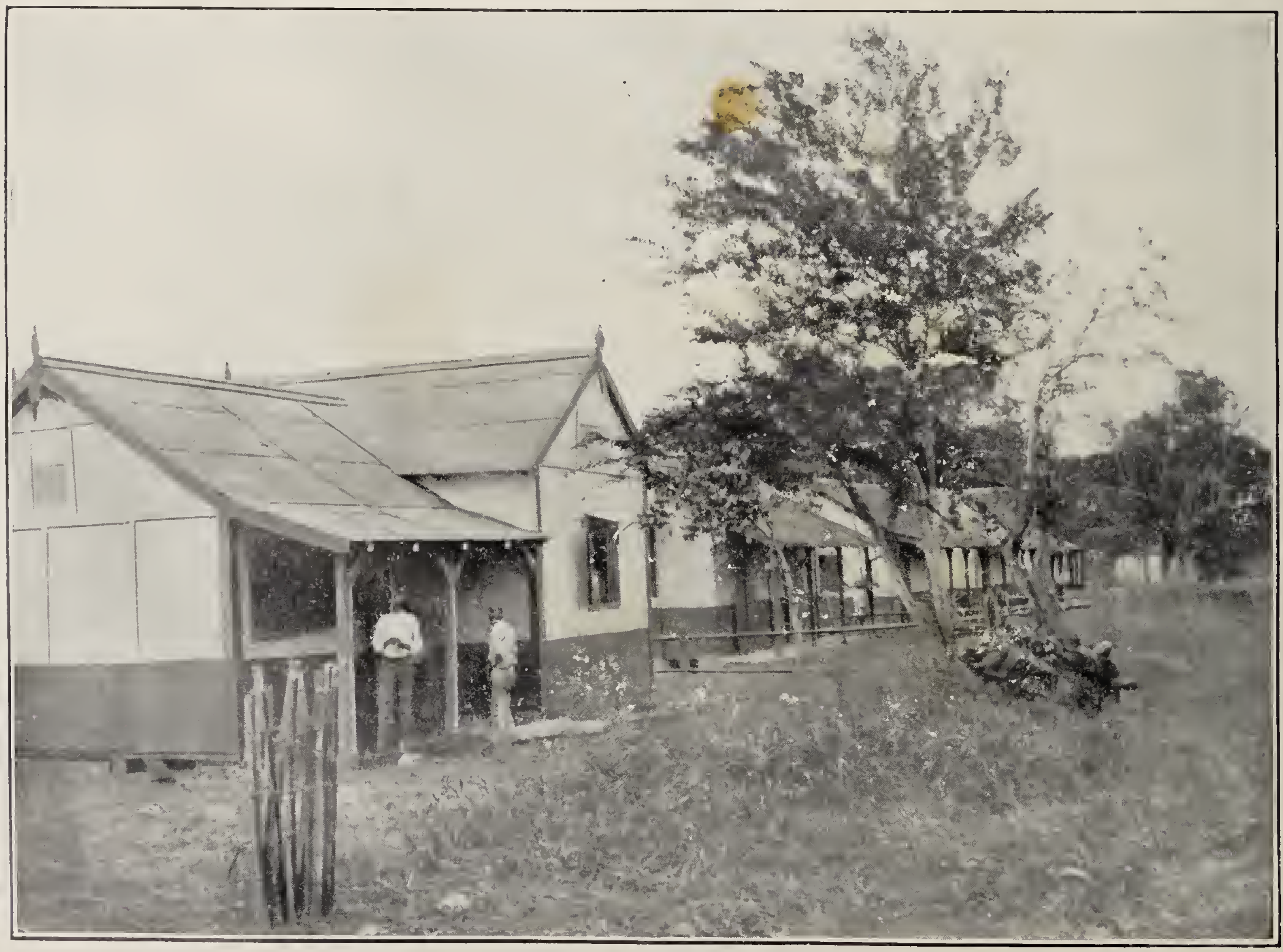
121.—Another example of an insanitary yard, Port Louis.



122.—A better class yard, Port Louis, surrounded by one-roomed dwellings.



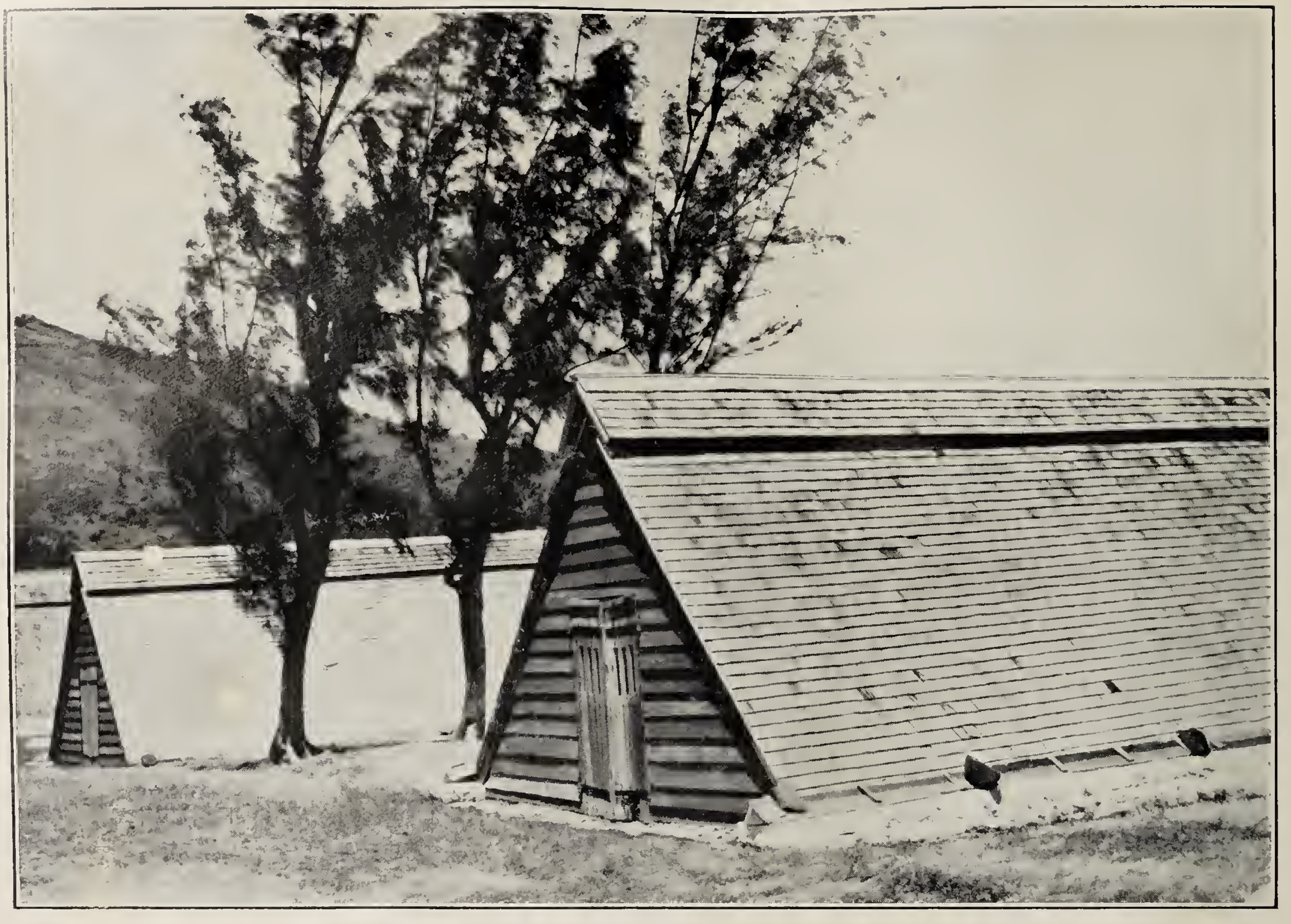
123.—Block of dwellings, new model village, Cassis. Communal kitchen on right.



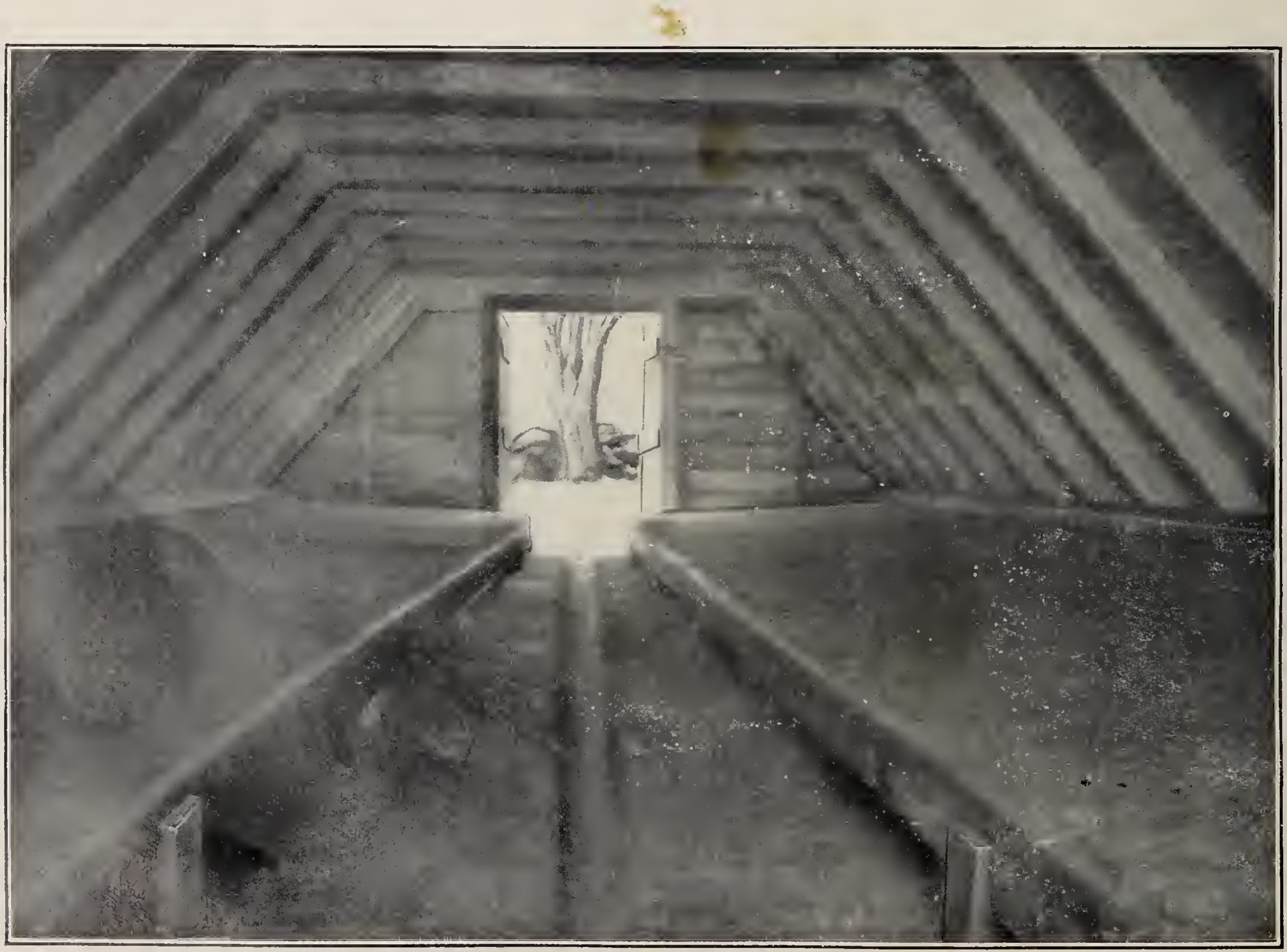
124.—Portion of the model village being erected by Sir Hesketh Bell at Cassis on the outskirts of Port Louis.

125.—Portion of the Champ de Mars, Port Louis, showing accumulation of refuse.

126.—Prickly Pear, a sanitary bugbear.



127.—Exterior of third class quarters. Quarantine Station, Flat Island.



128.—Interior of a third class quarter, Quarantine Station, Flat Island.

129.—The Bacteriological Laboratory, Réduit.

130.—Date palm showing the nests of weaver birds placed at the ends of the leaf fronds as a protection from monkeys, and exemplifying the truth of the proverb, "Prevention is better than cure."